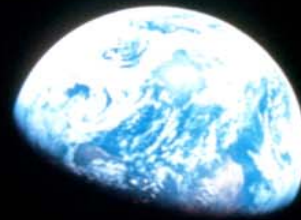


Risk Assessment: Climate Change, Insurance, and Utilities



Utility Executive Leadership Institute (UELI) 2007

Pinehurst Resort, North Carolina

August 10, 2007

Evan Mills, Ph.D.

Staff Scientist

University of California

U.S. Department of Energy

Lawrence Berkeley National Laboratory

Our atmosphere is as thin — in proportion to the Earth's diameter — as a film of condensation on a small steel ball.





**Variability is a fact of life;
but the dice are loaded**



Managing Risks for Utilities

(costs of impacts *and* adaptation)



Why Utilities, Insurance, and Climate Change?

- Electric and water utilities are insured (or self-insured, reinsured)
- Both sectors are weather- and climate-sensitive, and have to cope with shareholder, customer, regulator perceptions of the climate problem
- Both can be instrumental in climate solutions
- Both can work *together* on risk-management and new business opportunities

Roadmap

- State of the Science
 - fingerprints & forecasts
 - focusing on aspects most relevant to energy and water utilities
- Implications for Insurers & Utilities
- Managing Risks & Capturing Opportunities

State of the Science: Fingerprints

The Scientific Consensus

<http://www.ipcc.ch>

Intergovernmental Panel
on Climate Change
TAR - 1300 Authors;
1100 Reviewers
Unanimously adopted by 100+
nations (*including U.S.*)



IPCC's Latest Characterization of Climate Change

“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level.”

- IPCC Fourth Assessment Report (2007)

<http://www.ipcc.ch>

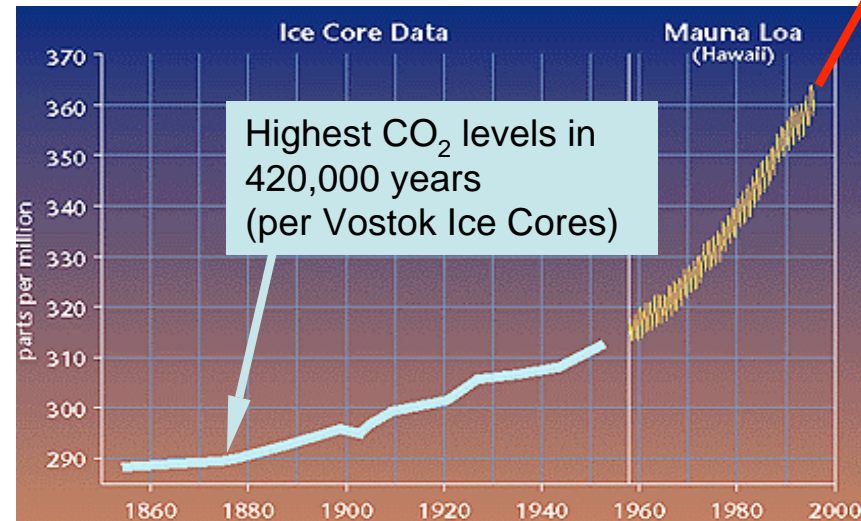
The Primary Human Influence is Fossil Fuels Combustion



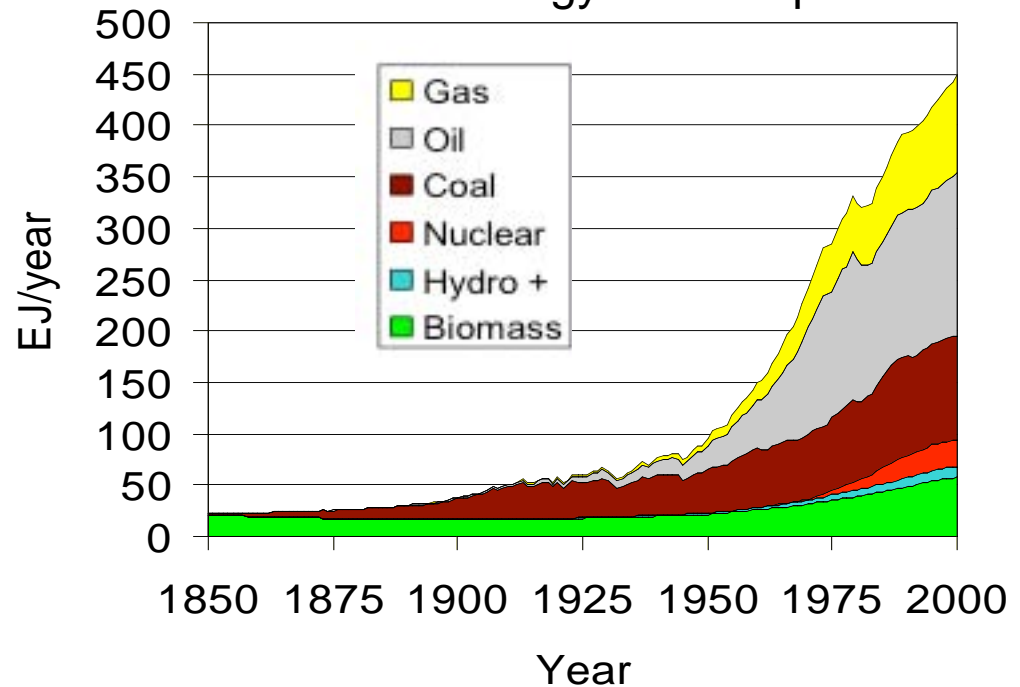
(Second is Deforestation)



World Carbon Dioxide Concentrations

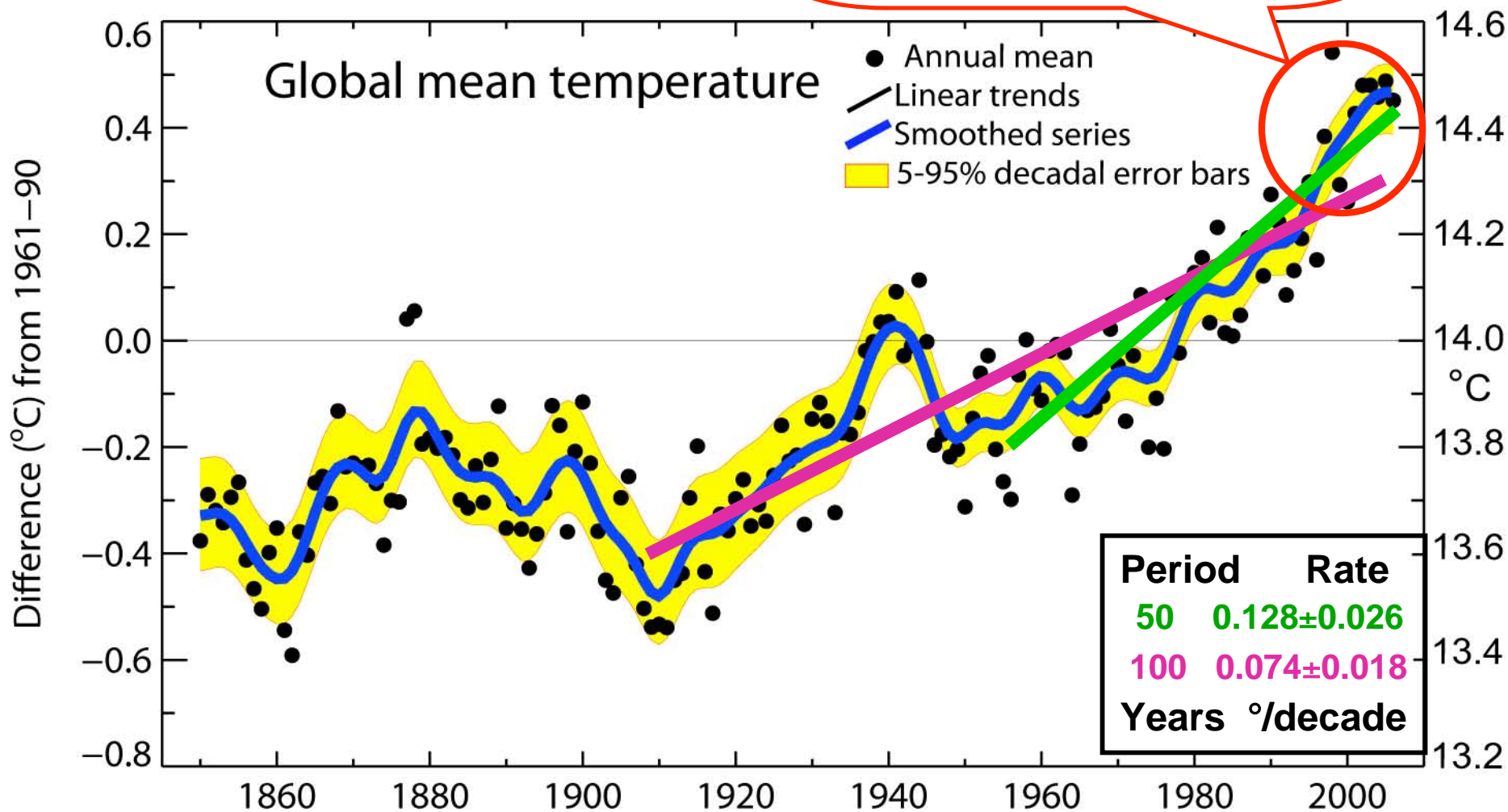


World Energy Consumption



Global mean temperatures are rising faste

Warmest 10 years:
1997-2006

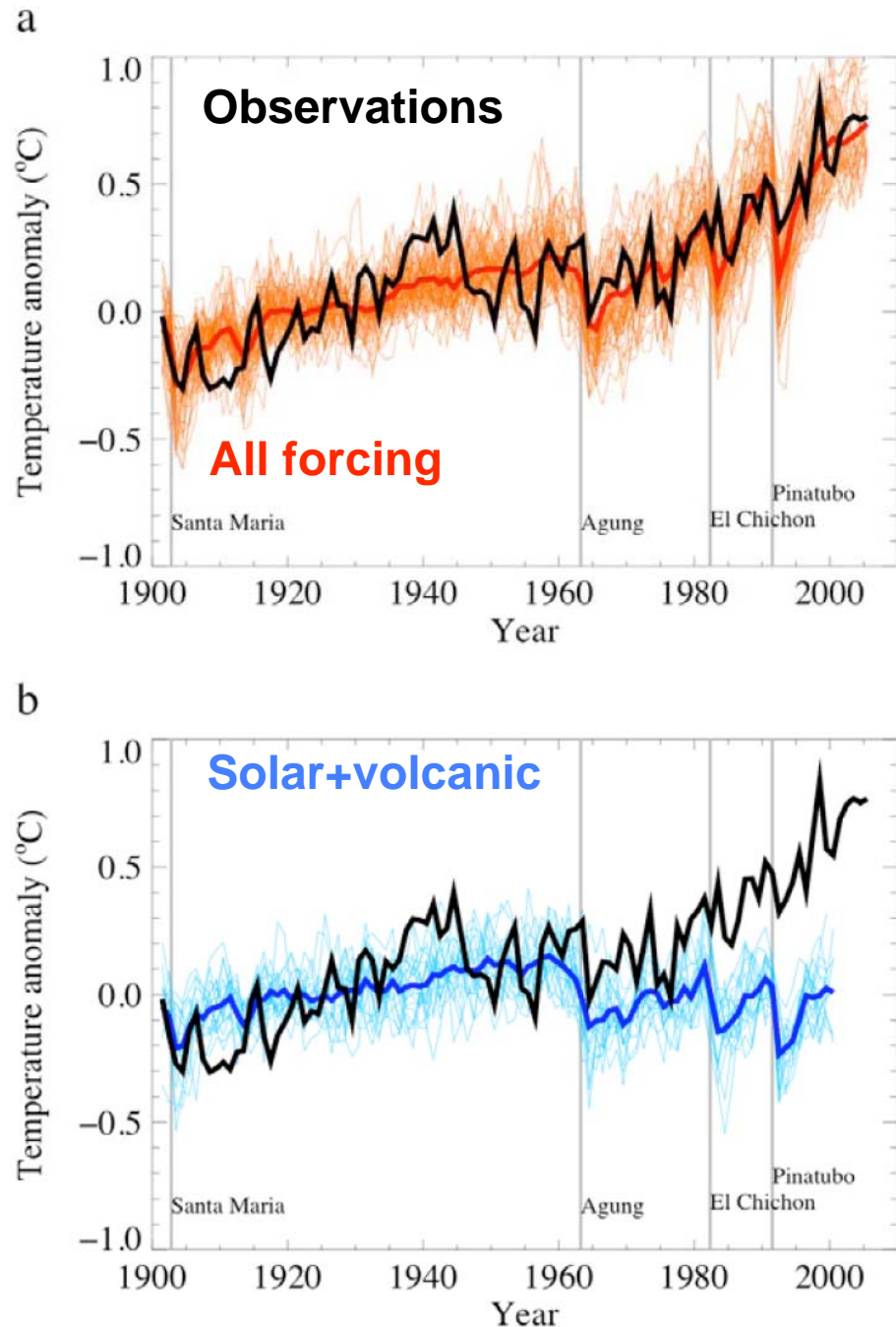


Source: IPCC 4th Assessment (2007)

Attribution

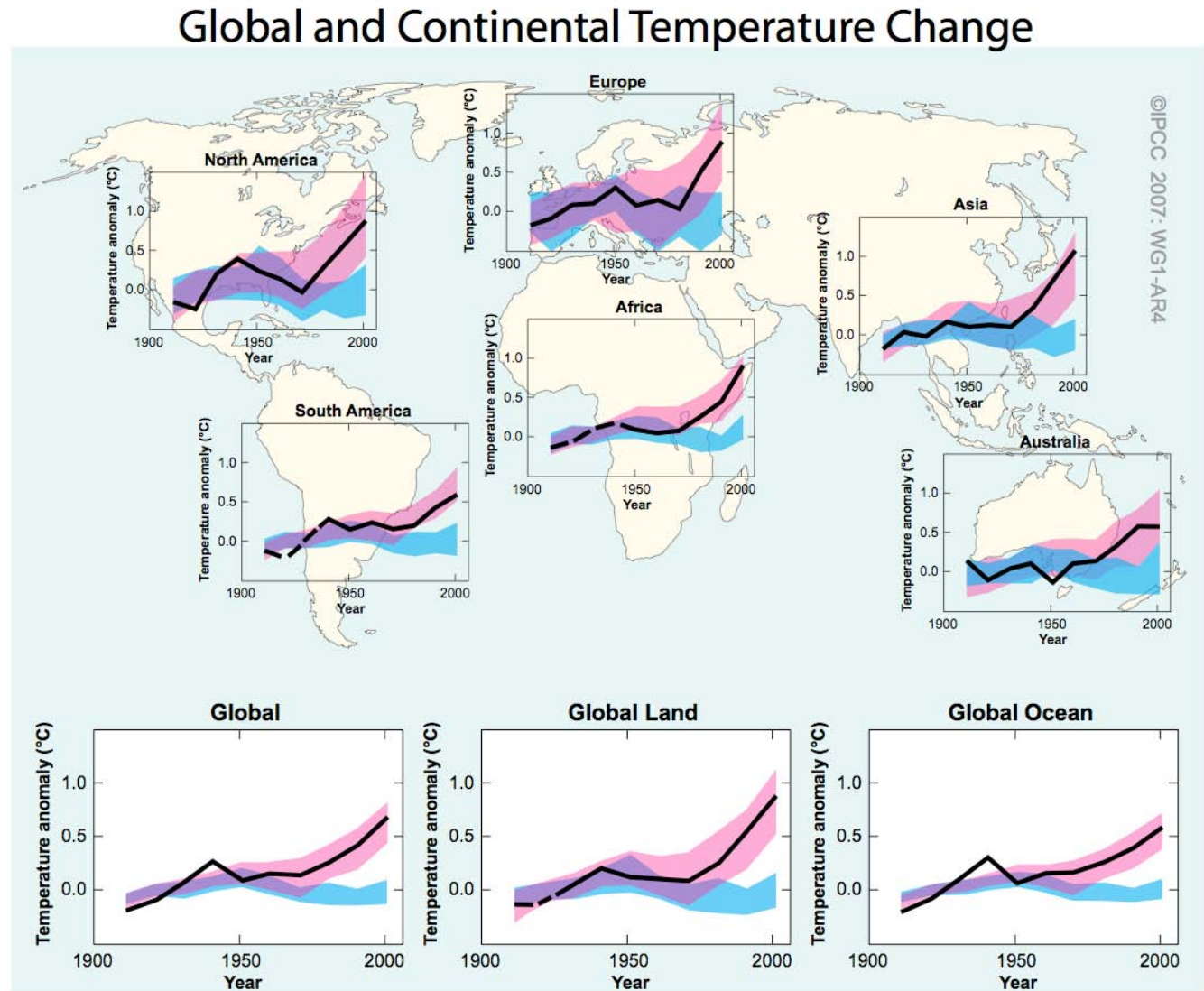
- Observed changes are consistent with:
 - ☒ expected responses to human activity
 - ☐ inconsistent with alternative explanations

Source: IPCC 4th Assessment (2007)



Human Activity is Main Driver of Observed Temperature Changes

Warming shows a significant human contribution over the past 50 years in all regions

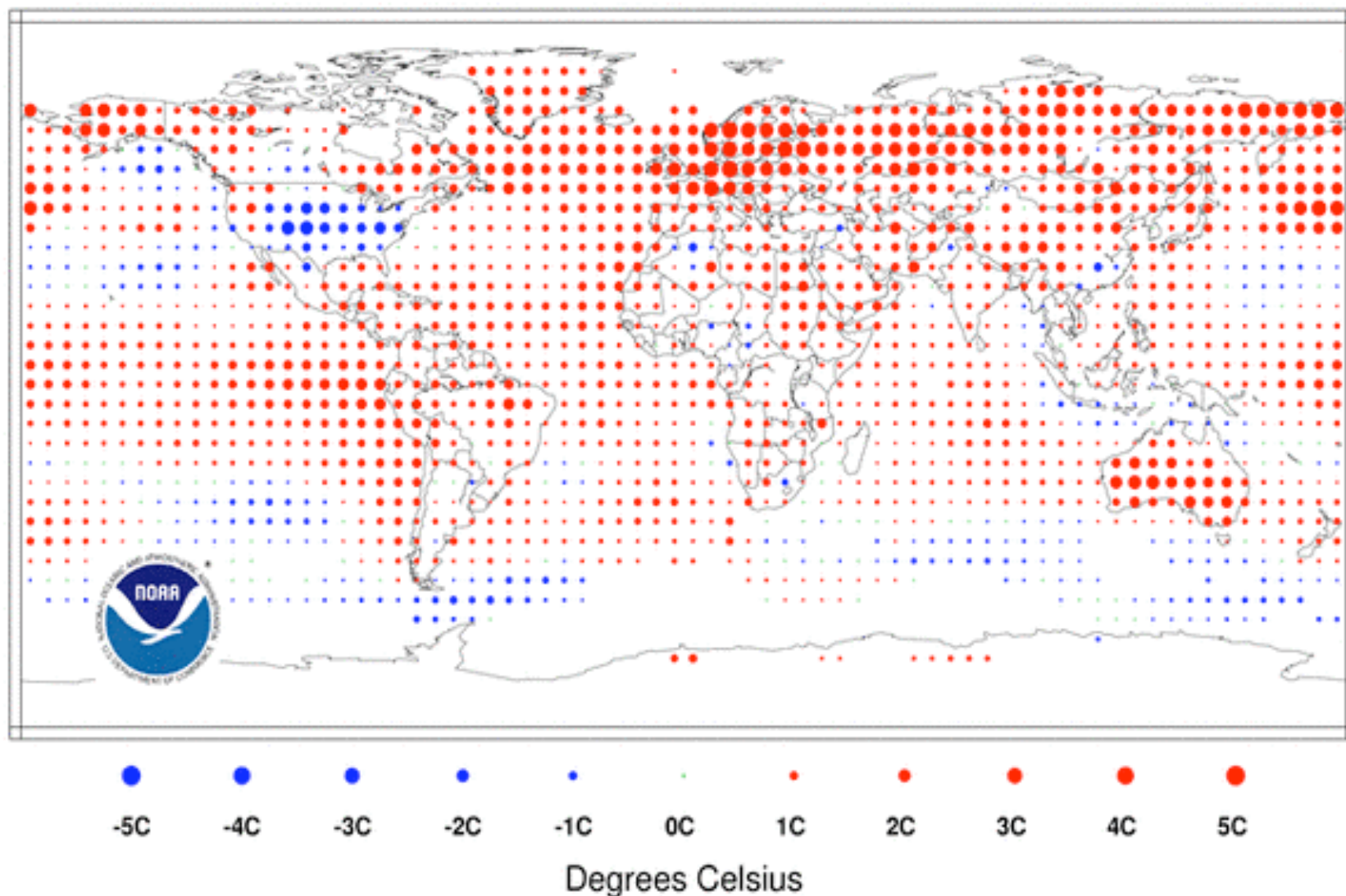


Source: IPCC 4th Assessment (2007)

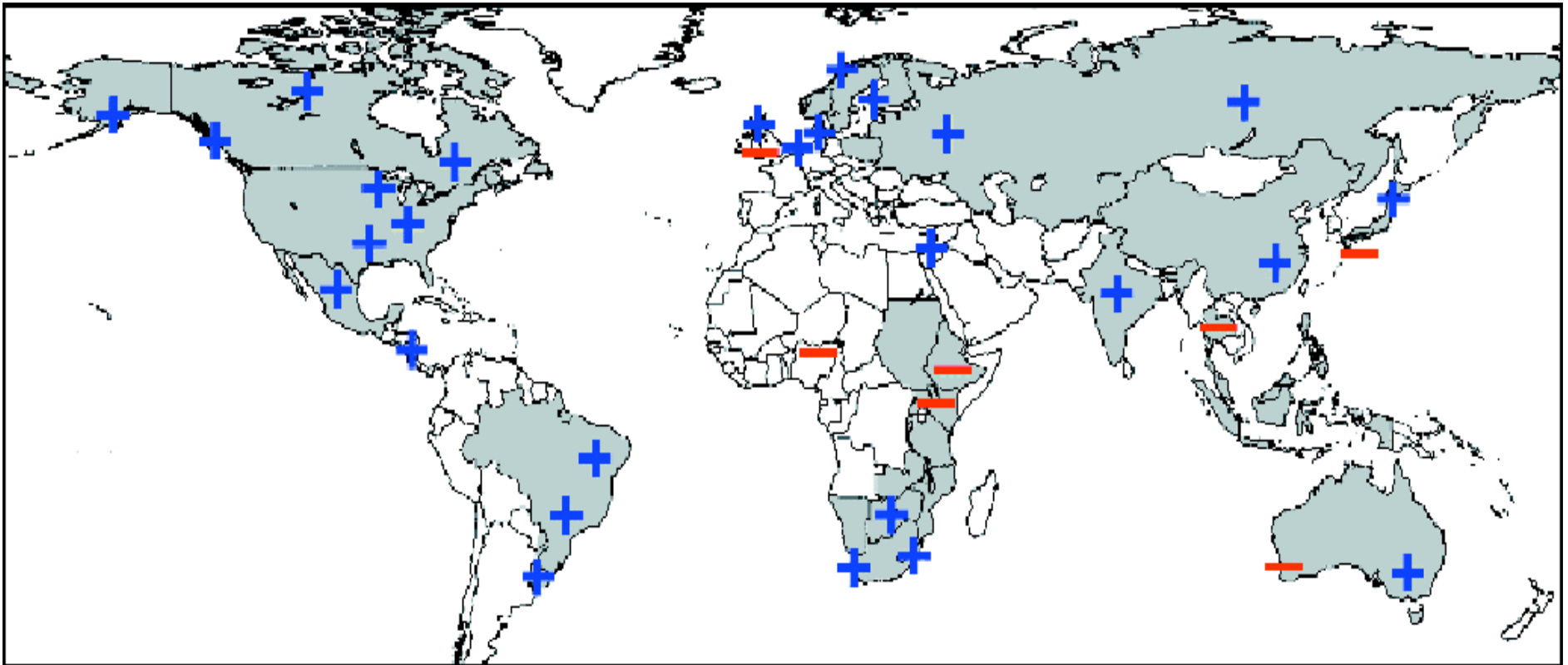
September 2006 Temperature Anomalies

(with respect to a 1961-1990 base period)

National Climatic Data Center/NESDIS/NOAA



Fingerprints.... Torrential Rain

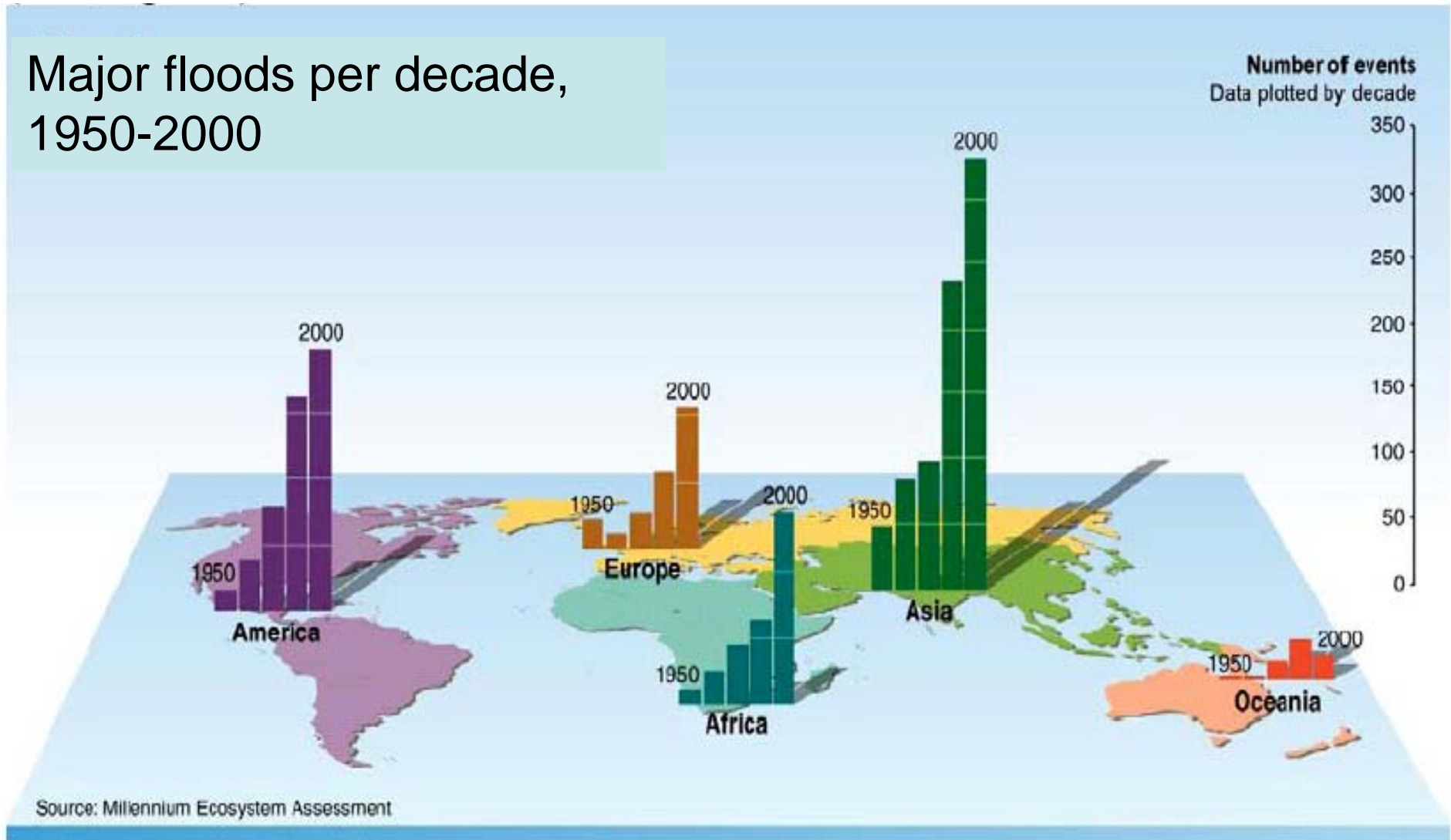


Regions of observed disproportionate changes in heavy (95th %-ile) and very heavy (99th %-ile) precipitation

Source: IPCC 4th Assessment (2007)

Fingerprints.... Floods

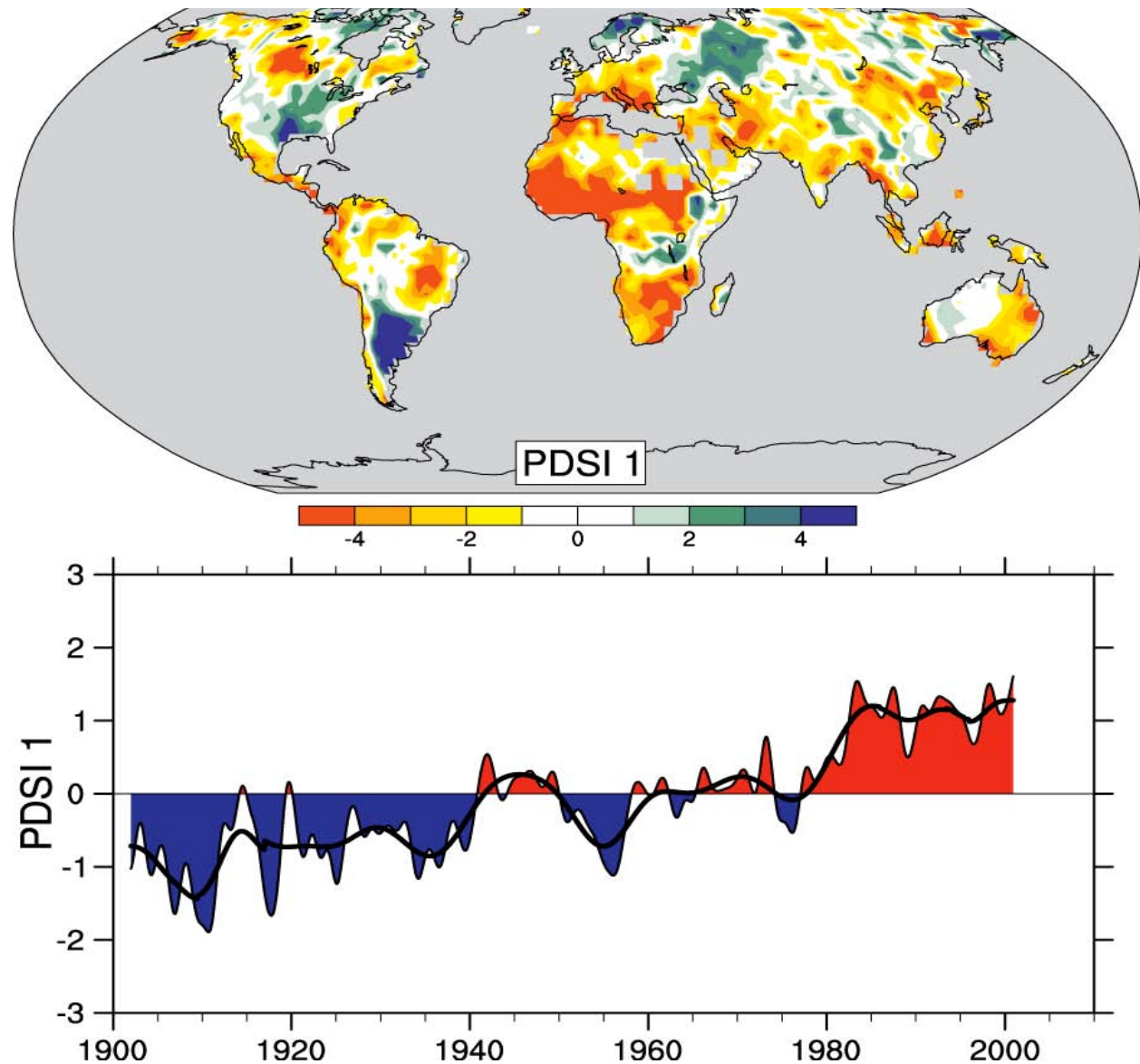
Major floods per decade,
1950-2000



There's a consistent 50-year upward trend in every region except Oceania.

Fingerprints.... Drought

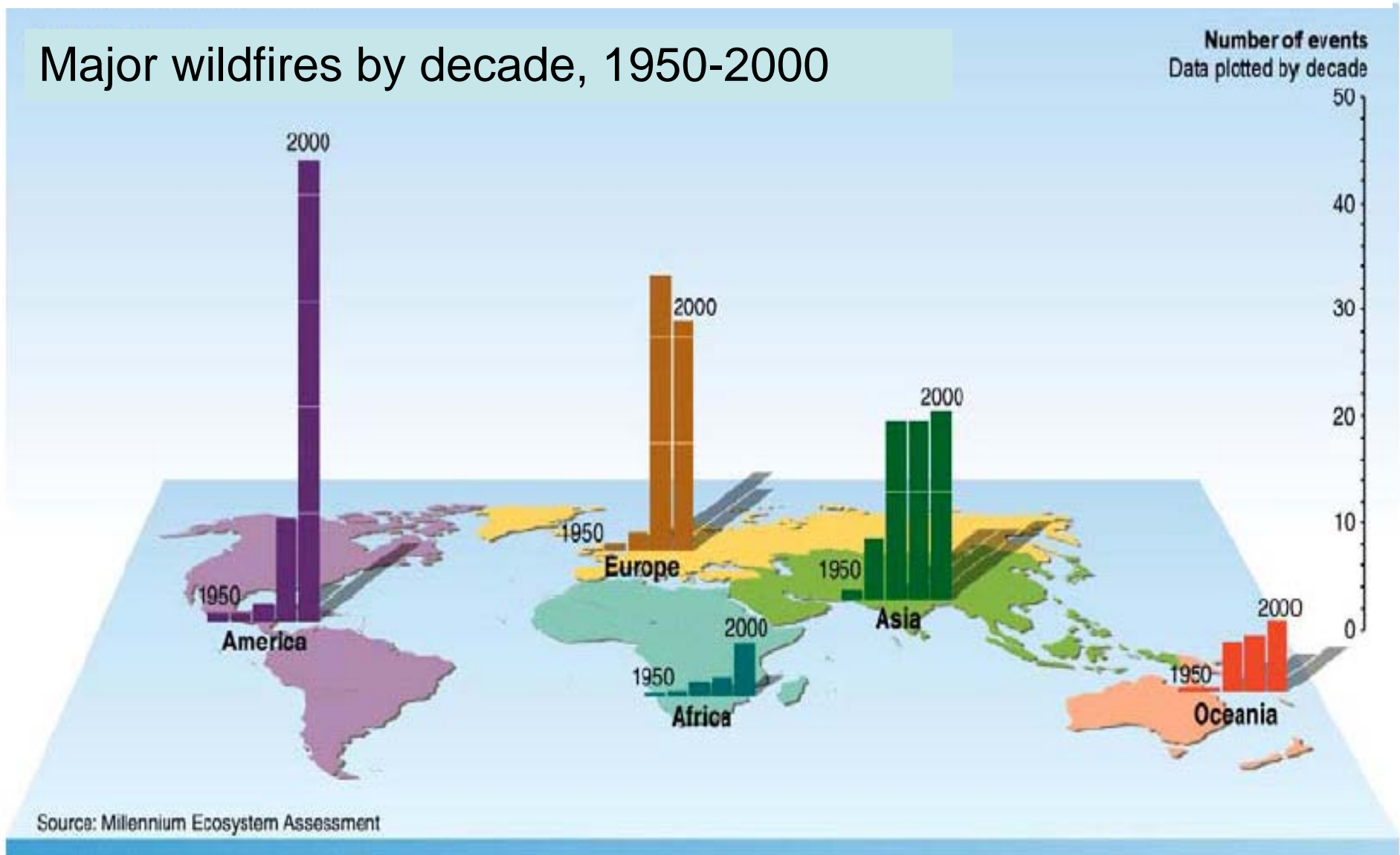
Change in
Palmer Drought
Severity Index
(PDSI) for 1900
to 2002



Source: IPCC 4th Assessment (2007)

Fingerprints.... Wildfire

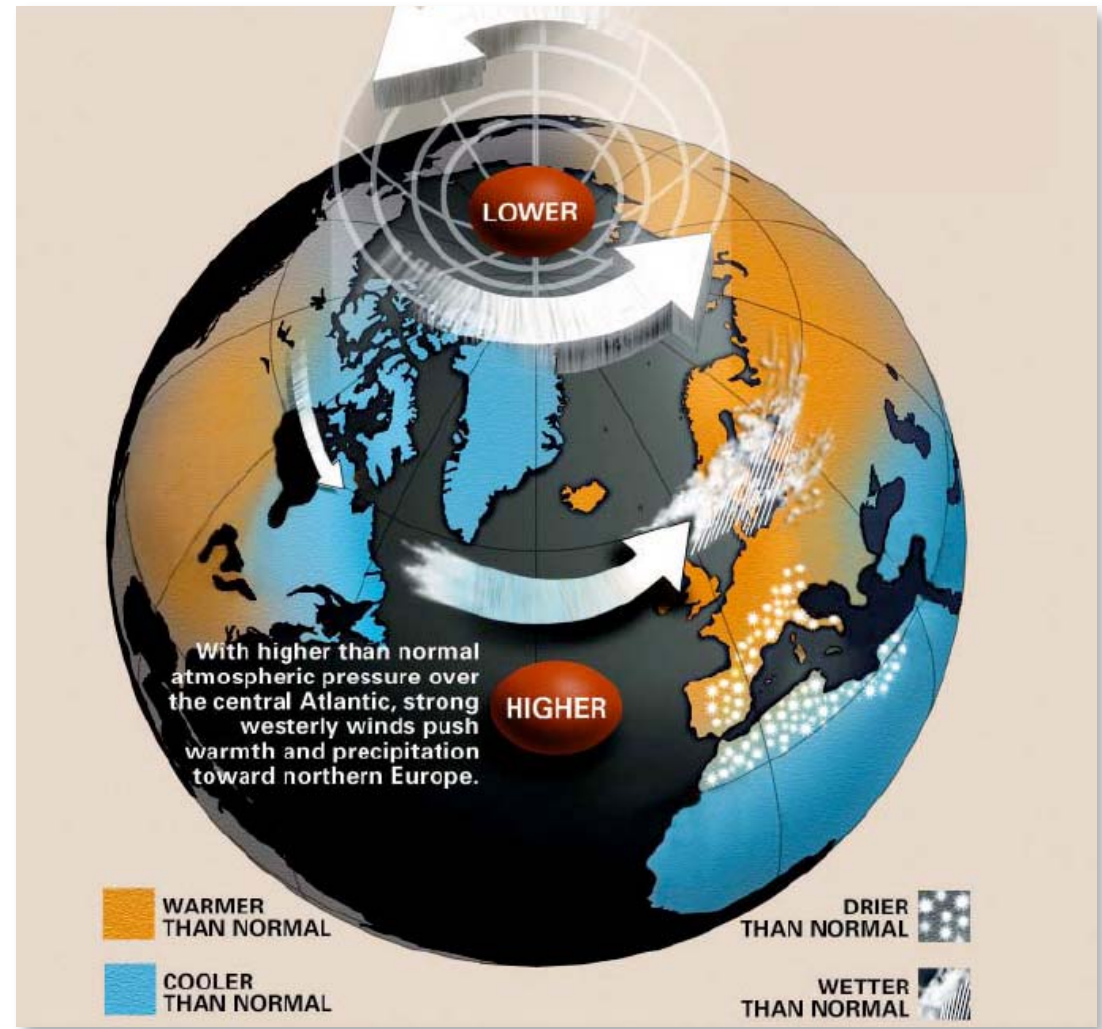
Major wildfires by decade, 1950-2000



The trend has been sharply upward everywhere.

Fingerprints.... Storms

- Climate change is affecting storm tracks, winds and temperature patterns
- Human-induced forcing has likely contributed



Source: IPCC 4th Assessment (2007)

Fingerprints: Loss of Ice & Snow Cover (Summer -7.4% per decade)

- Loss of land ice --> sea-level rise
- “Darkens” Earth’s surface
- “Freshens” oceans

NASA

NORTH
POLE

Since 1979, more than
20% of the Polar Ice Cap
has melted away.

ARCTIC SEA
ICE BOUNDARY IN 1979

Harvard Expedition to North Pole

... free water



Source: James McCarthy, Harvard

Larsen-B Ice Sheet



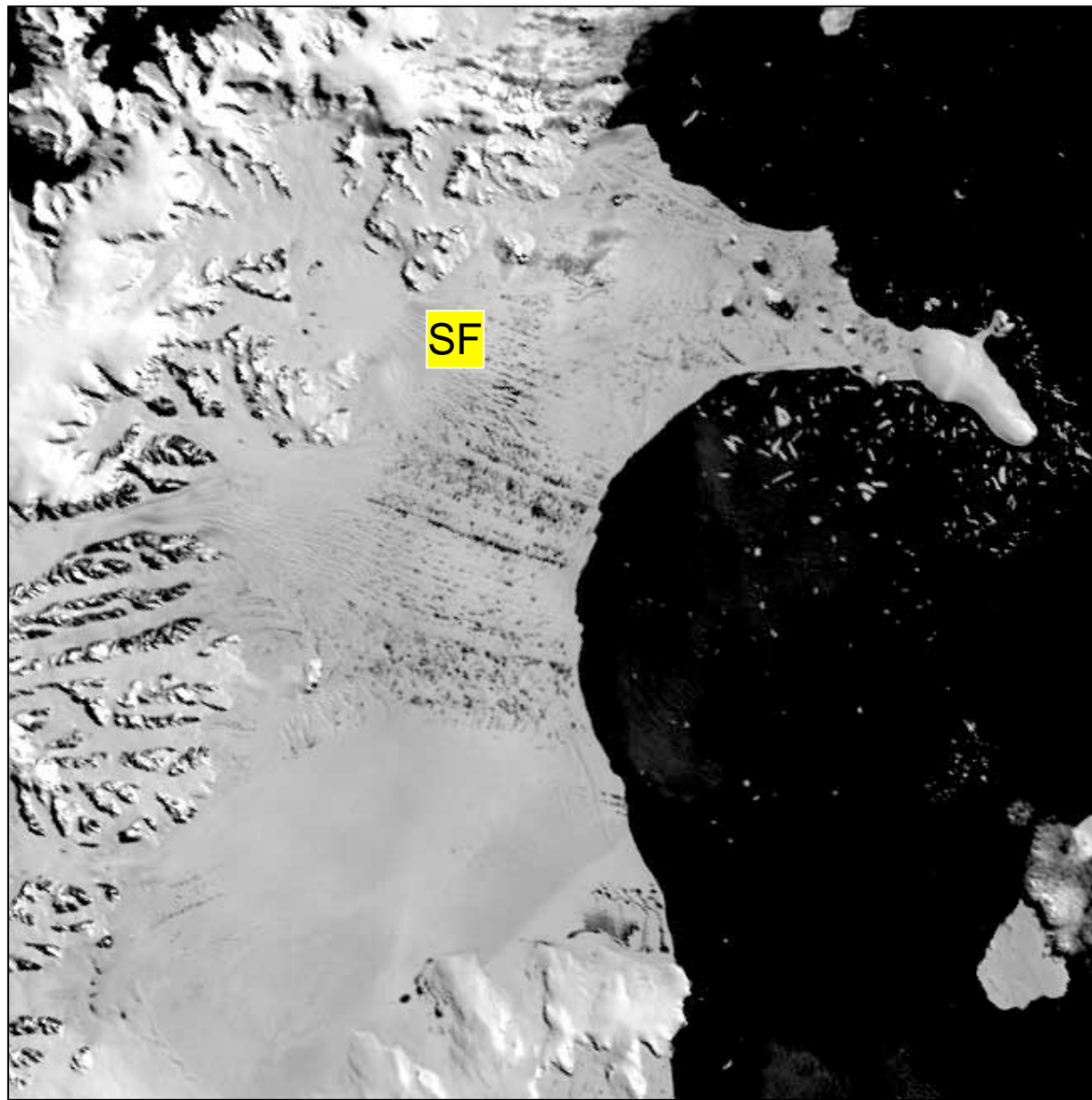
Image NASA

©2006 Google

Pointer 87°32'33.79" S 86°21'17.38" E

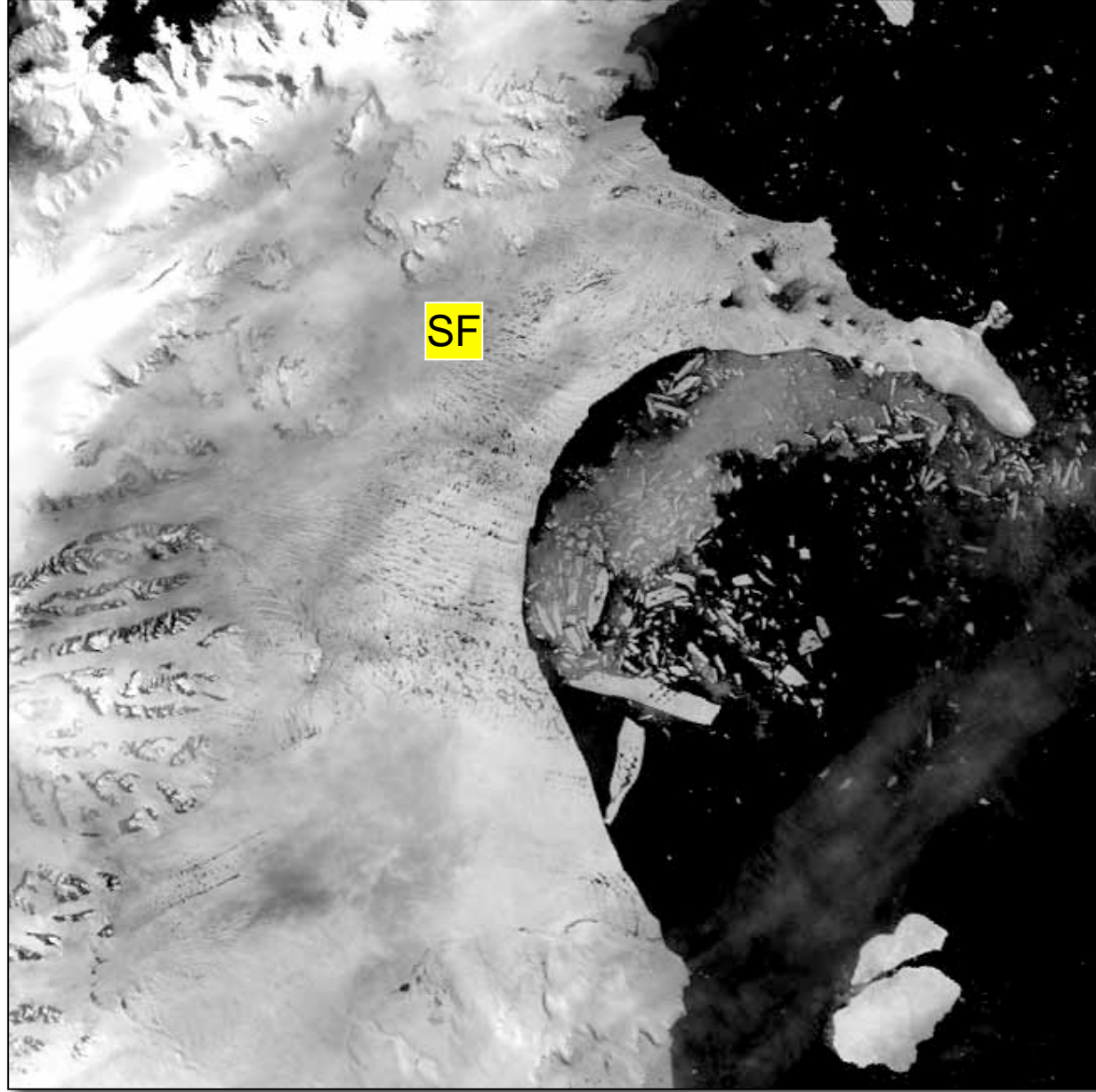
Streaming ||||| 100%

Eye alt 8466.64 km

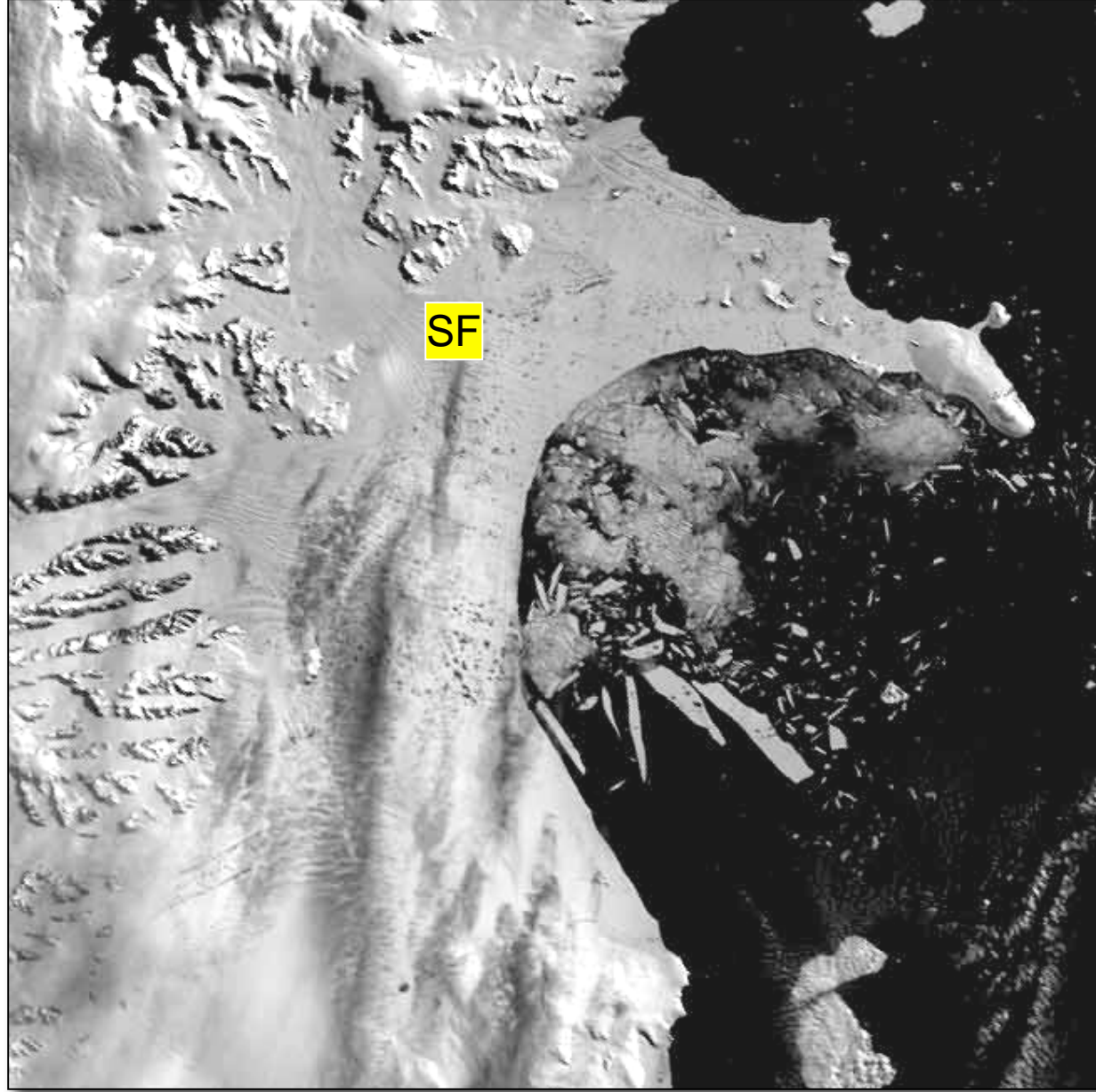


Jan 31
2002

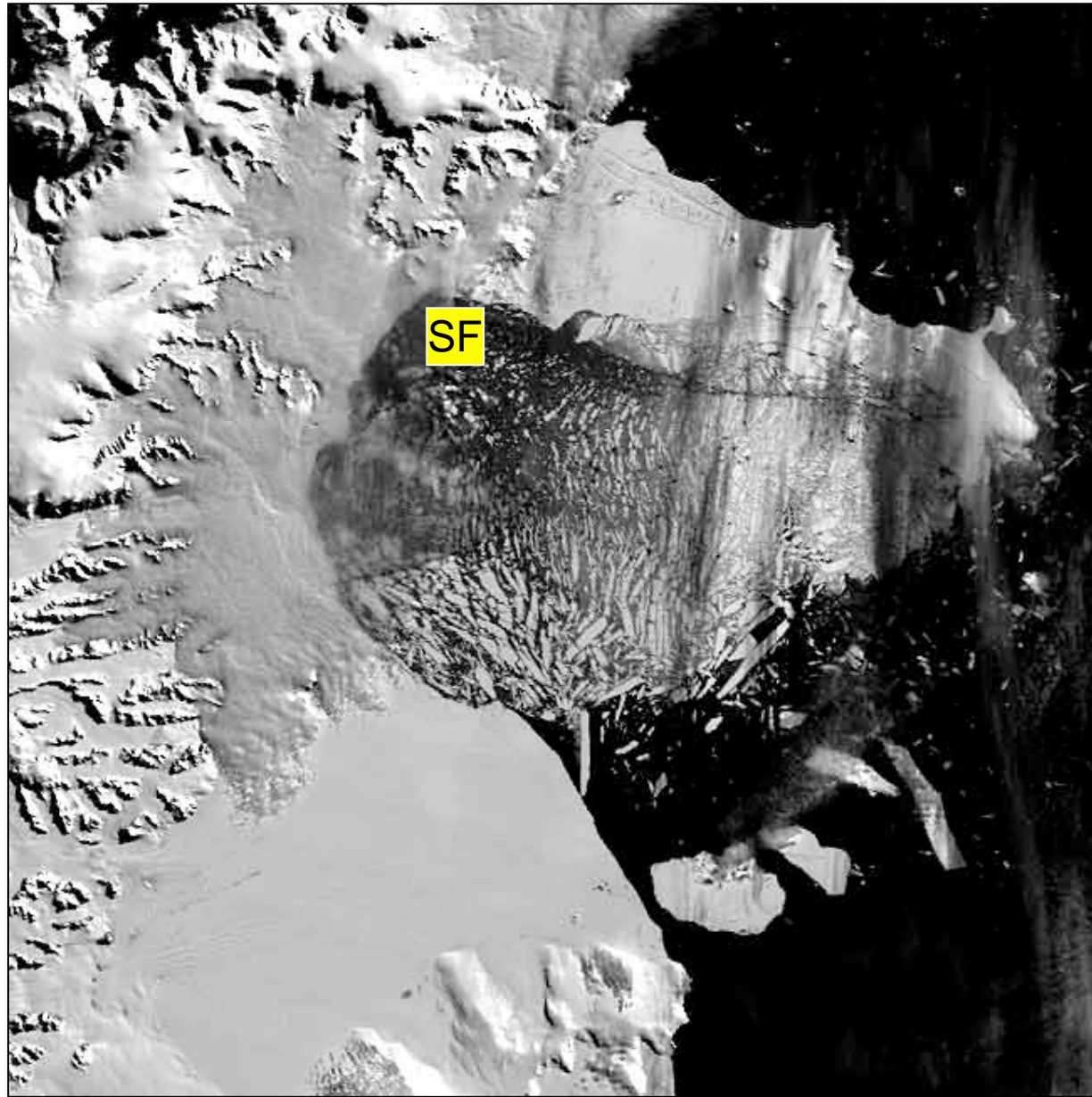
Larsen B
Ice Shelf



Feb 17



Feb 23



March 5

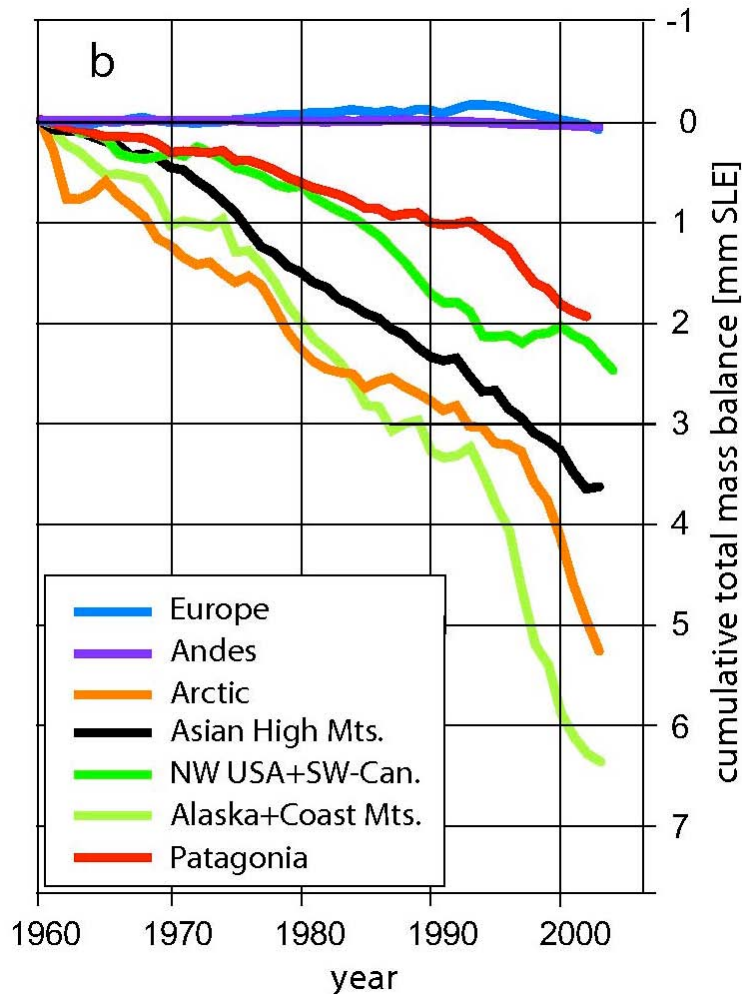
1255
square
miles
[24x San
Francisco]

650 feet
thick [4.3
Lake Tahoes]

720 billion
tons

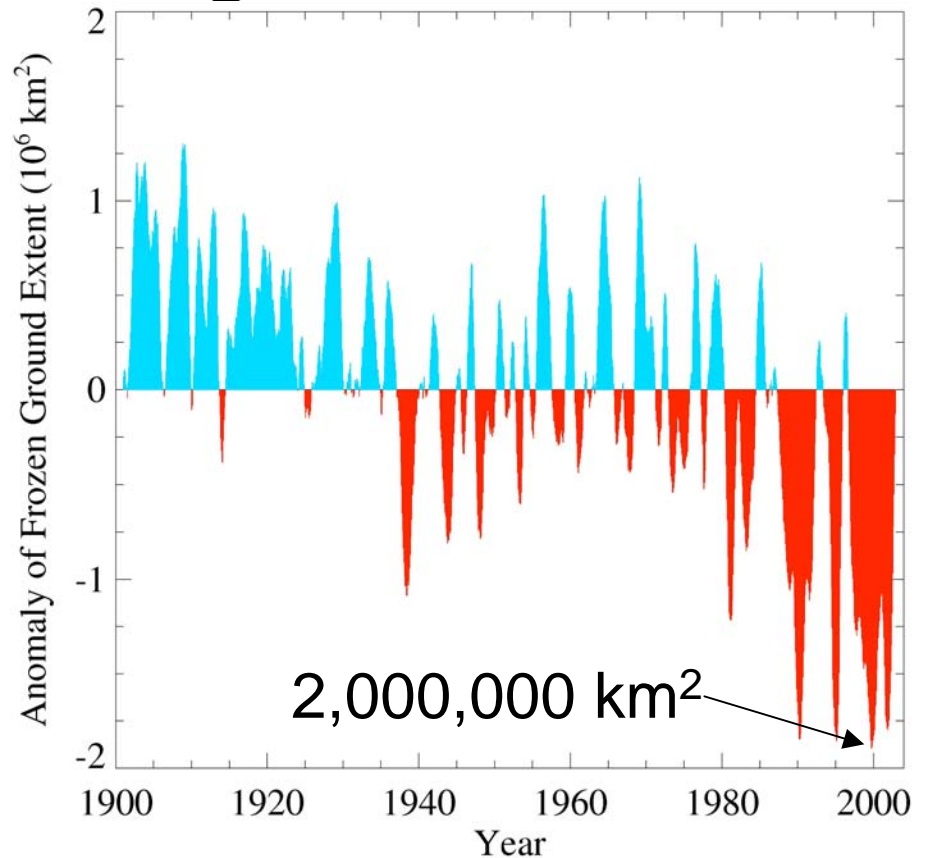
Subsequent 8x
increase in
outflow
glacier speed

Fingerprints ... Glaciers & frozen ground are receding



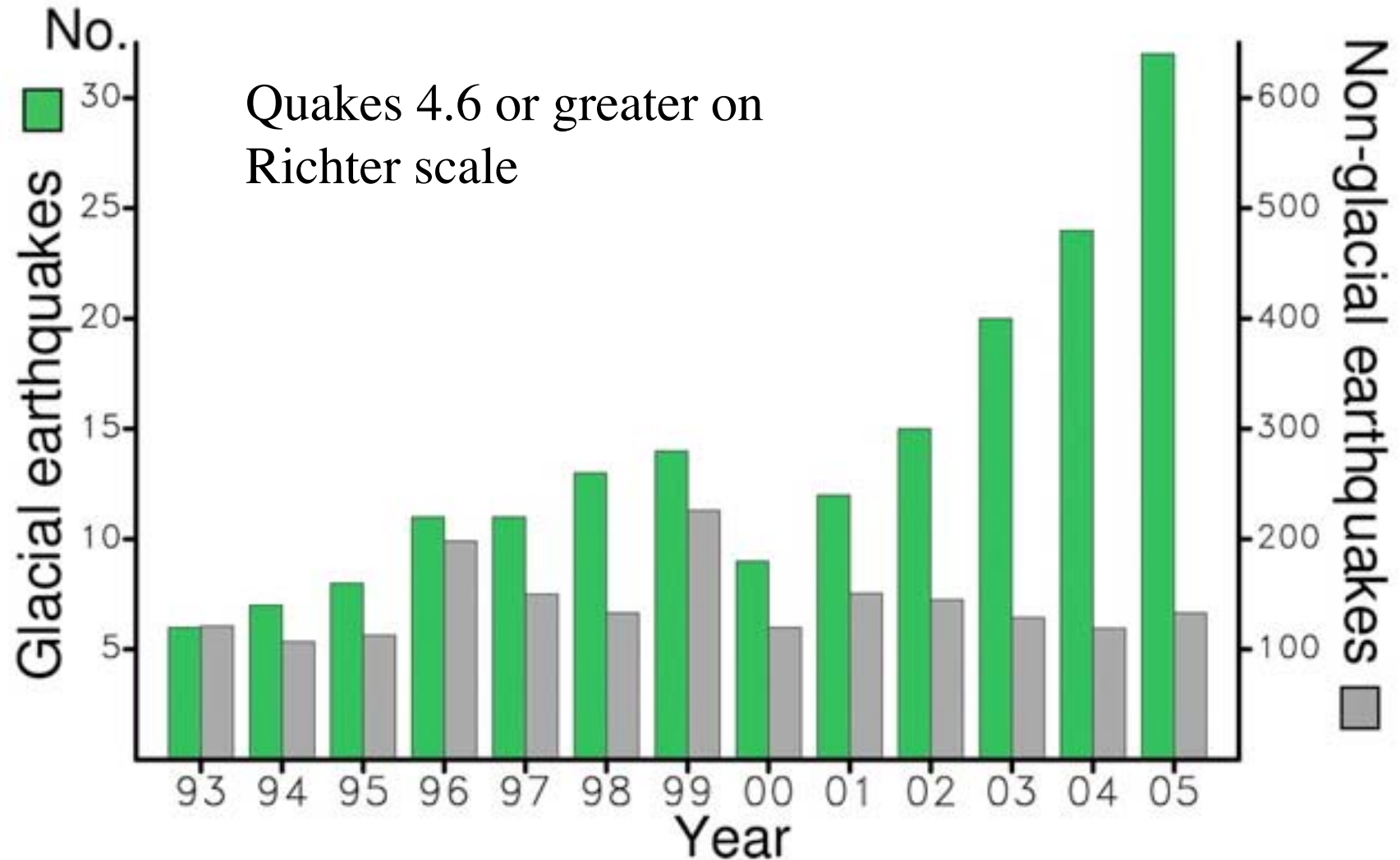
Accelerating since early 1990s

Source: IPCC 4th Assessment (2007)

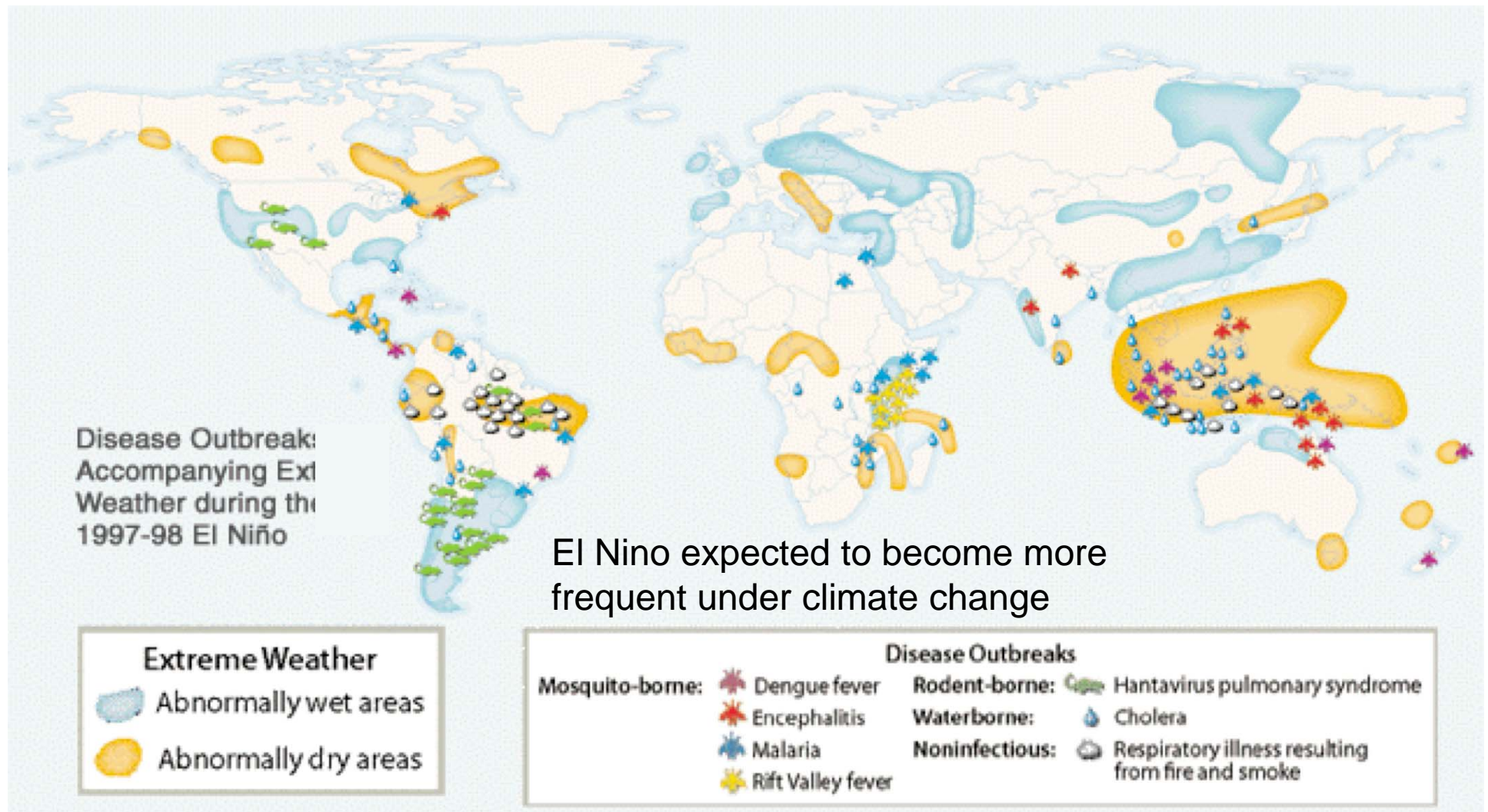


Area of seasonally frozen ground in the northern hemisphere has decreased by 7% from 1901 to 2002

Fingerprints ... Glacial Earthquakes



Correlation of Disease Clusters with the 1997-1998 El Nino Weather Extremes

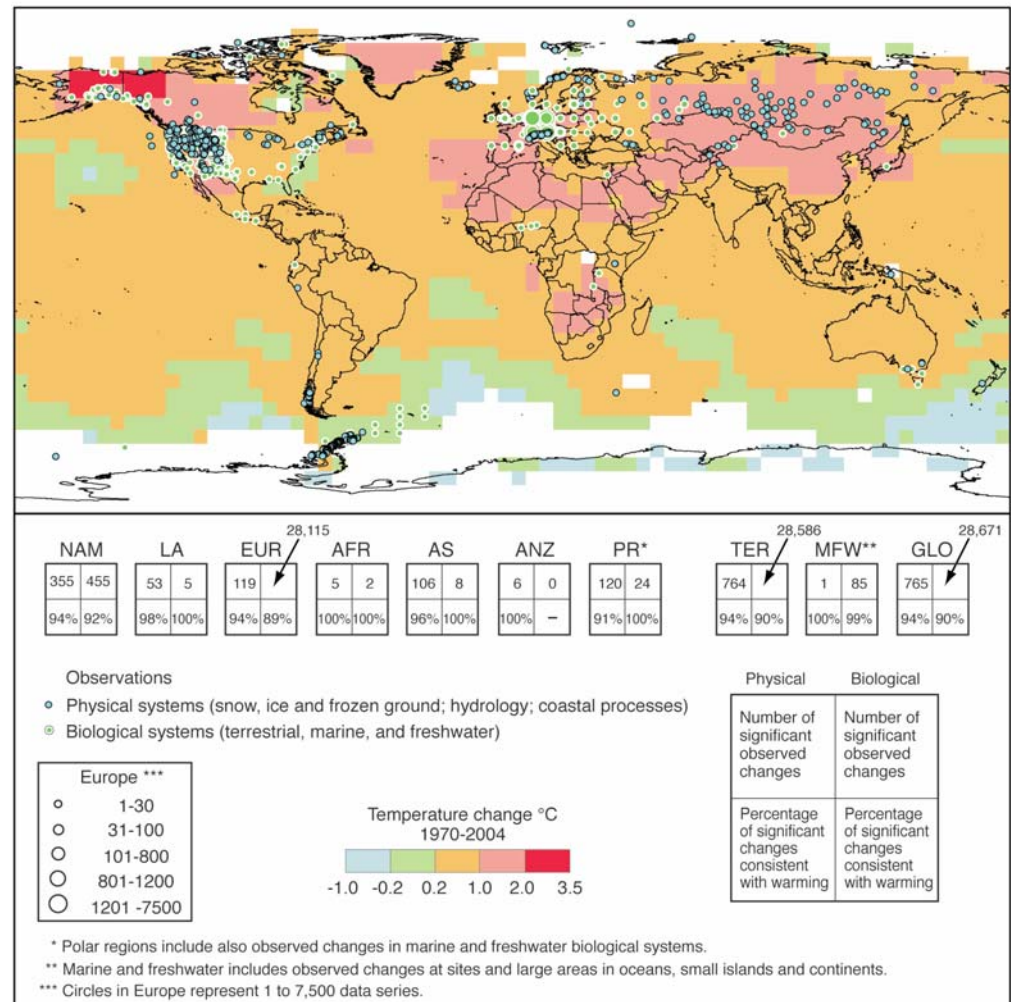


Source: Epstein, Harvard Medical School, *Science*

Overwhelming Correlations

Synthesis of Scientific Literature on Observed Changes 1970-2004

- 577 studies reviewed
- 765 observed **physical** changes (94% consistent with warming)
- 28,671 observed **biological** changes (90% consistent with warming)

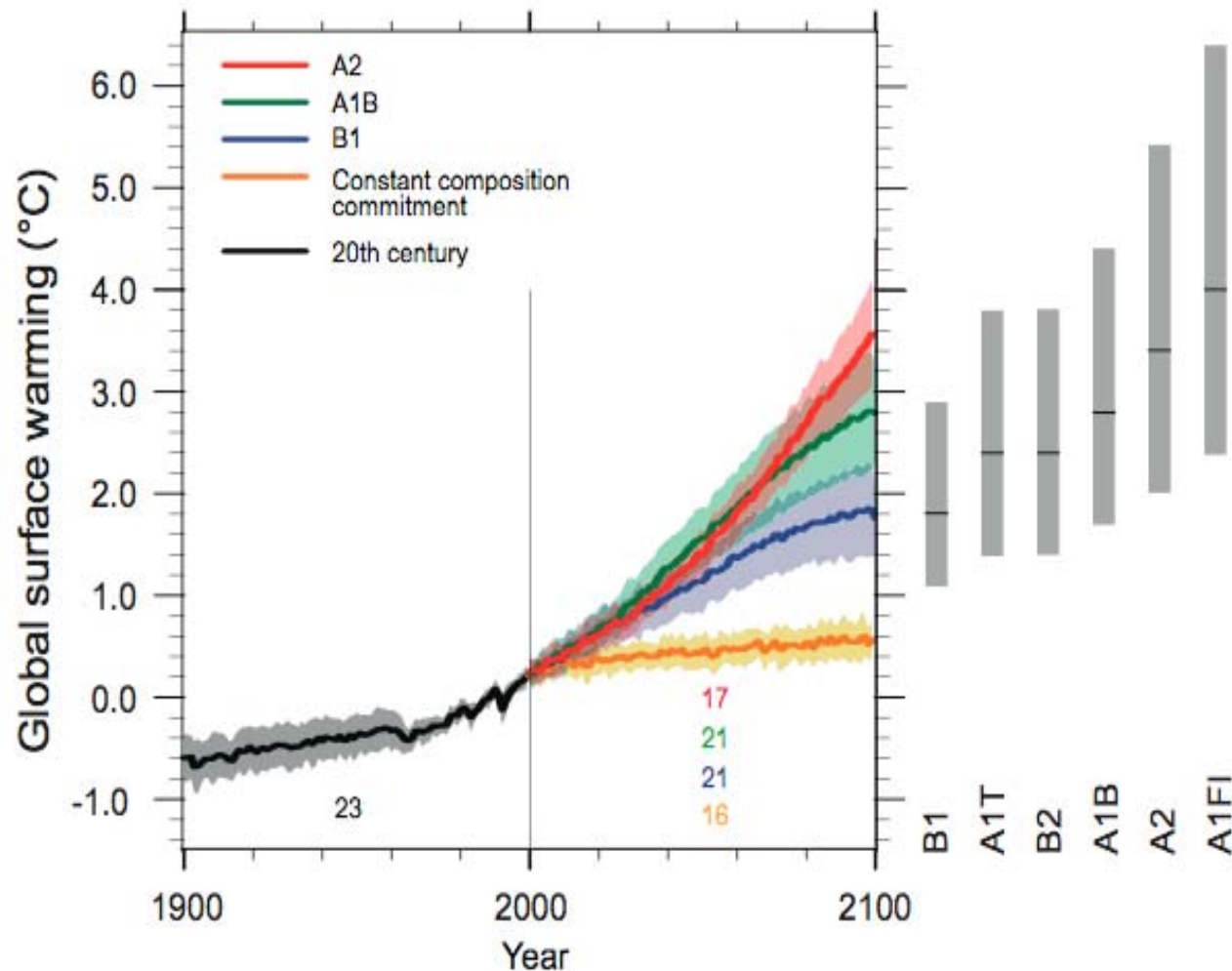


Source: IPCC 4th Assessment (2007)

State of the Science: Forecast

IPCC (2007) Projections of Future Changes in Climate

Best estimate for low scenario (B1) is 1.8°C (*likely* range is 1.1°C to 2.9°C), and for high scenario (A1FI) is 4.0°C (*likely* range is 2.4°C to 6.4°C).



Source: IPCC 4th Assessment (2007)

IPCC Change in Runoff: 2041-2060

(Average of 12 models -- Western US results are among the more robust)

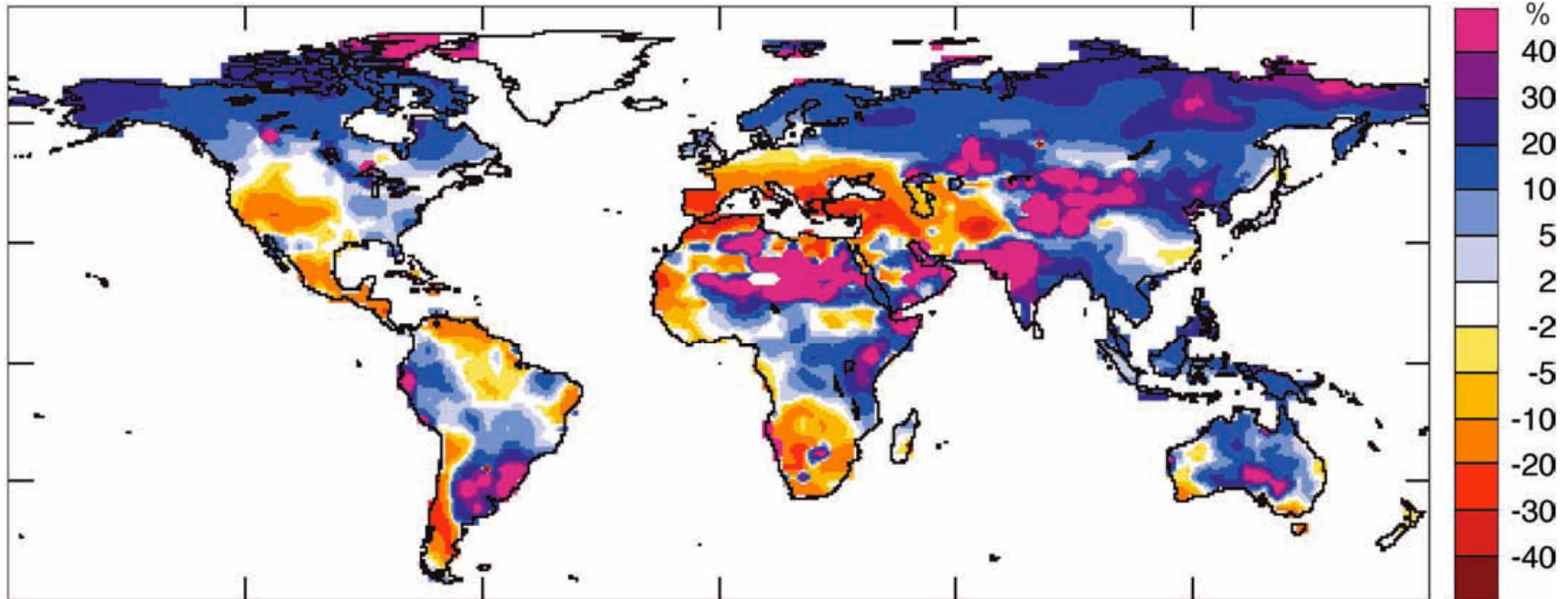


Figure 3.4. Change in annual runoff by 2041-60 relative to 1900-70, in percent, under the SRES A1B emissions scenario and based on an ensemble of 12 climate models (Milly et al., 2005).

Proportion of land area in extreme drought predicted to increase from 1-3% to 30% by 2090s. Drought duration expected to increase six-fold.

Source: IPCC 4th Assessment (2007)

Change in Recurrence of 100-year Droughts

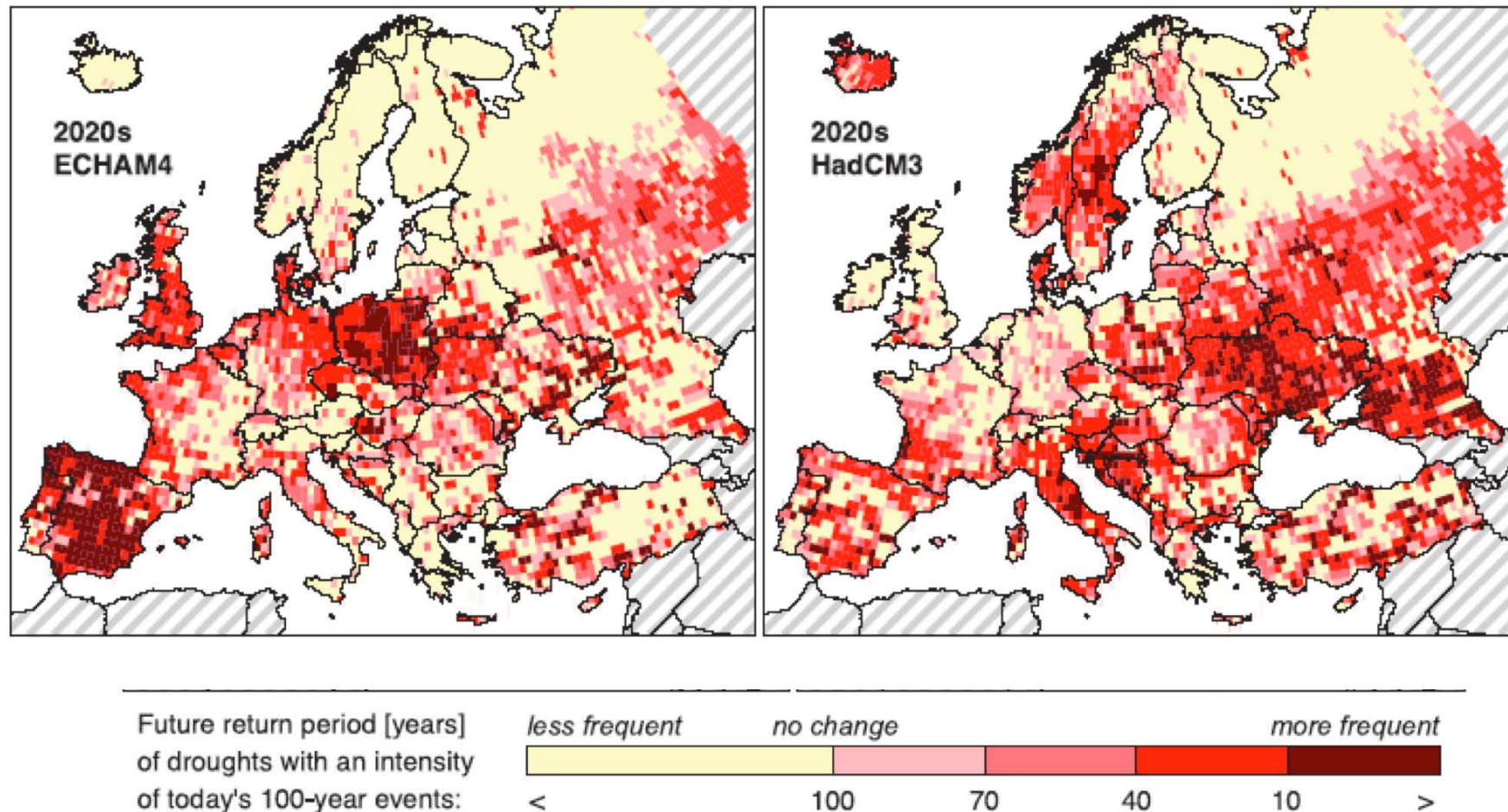


Figure 3.6. Change in the recurrence of 100-year droughts, based on comparisons between climate and water use in 1961 to 1990 and simulations for the 2020s and 2070s (based on the ECHAM4 and HadCM3 GCMs, the IS92a emissions scenario and a business-as-usual water-use scenario). Values calculated with the model WaterGAP 2.1 (Lehner et al., 2005b).

Source: IPCC 4th Assessment (2007), Ch 3

The Consensus

- **Human-induced climate change is here:**
we've been studying this for over a century
- The climate consensus, is about as good as it ever gets in science.
 - It's about like that for:
 - Human evolution
 - Health consequences of tobacco smoke
- One can quibble with specific points, but not with the systematic observed pattern of evidence
- Uncertainties are explicit; and are shrinking
- No alternate theory has been advanced

Open Questions

- Not the existence of human-induced climate change, or lack thereof, but rather:
 - How much?
 - How fast?
 - Smooth versus abrupt change
 - Feedbacks
 - Positive
 - Negative
 - Geography of impacts; downscaling
 - Gaps in models (especially cryosphere)
 - Attribution of *Impacts*
 - Society's ability to adapt
 - Costs of mitigation and adaptation
 - Policy pathways

Donuts Exist Despite the Holes



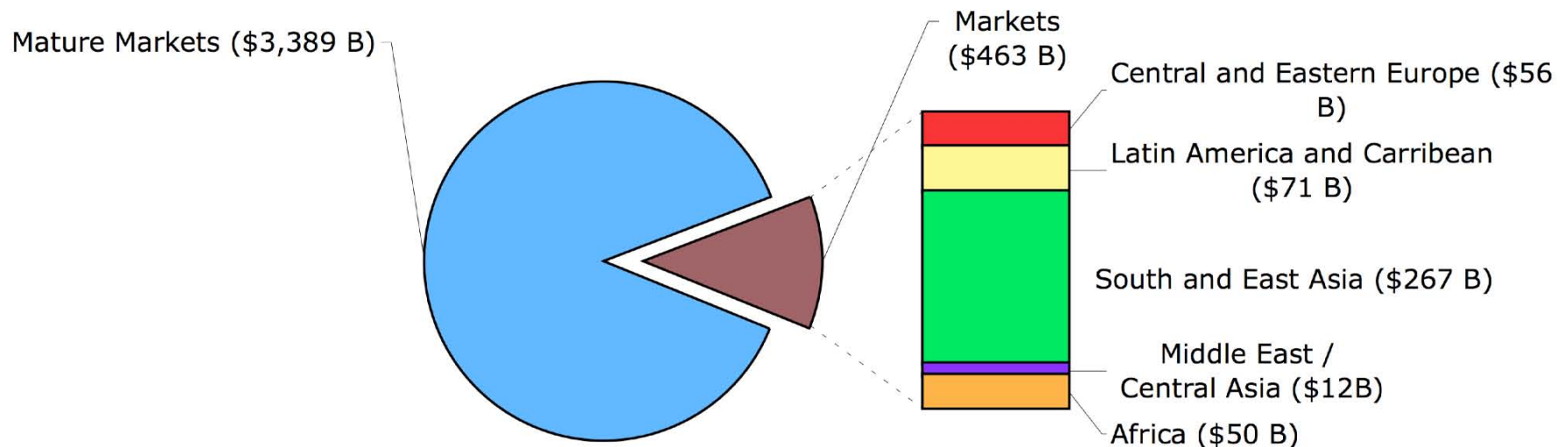
Source: Krispy Creme

Risks for Insurers & Utilities

\$3.8 Trillion

World Insurance Market

- World's biggest industry
- Important to all other business segments
- Major player in financial markets
- Enormous political influence

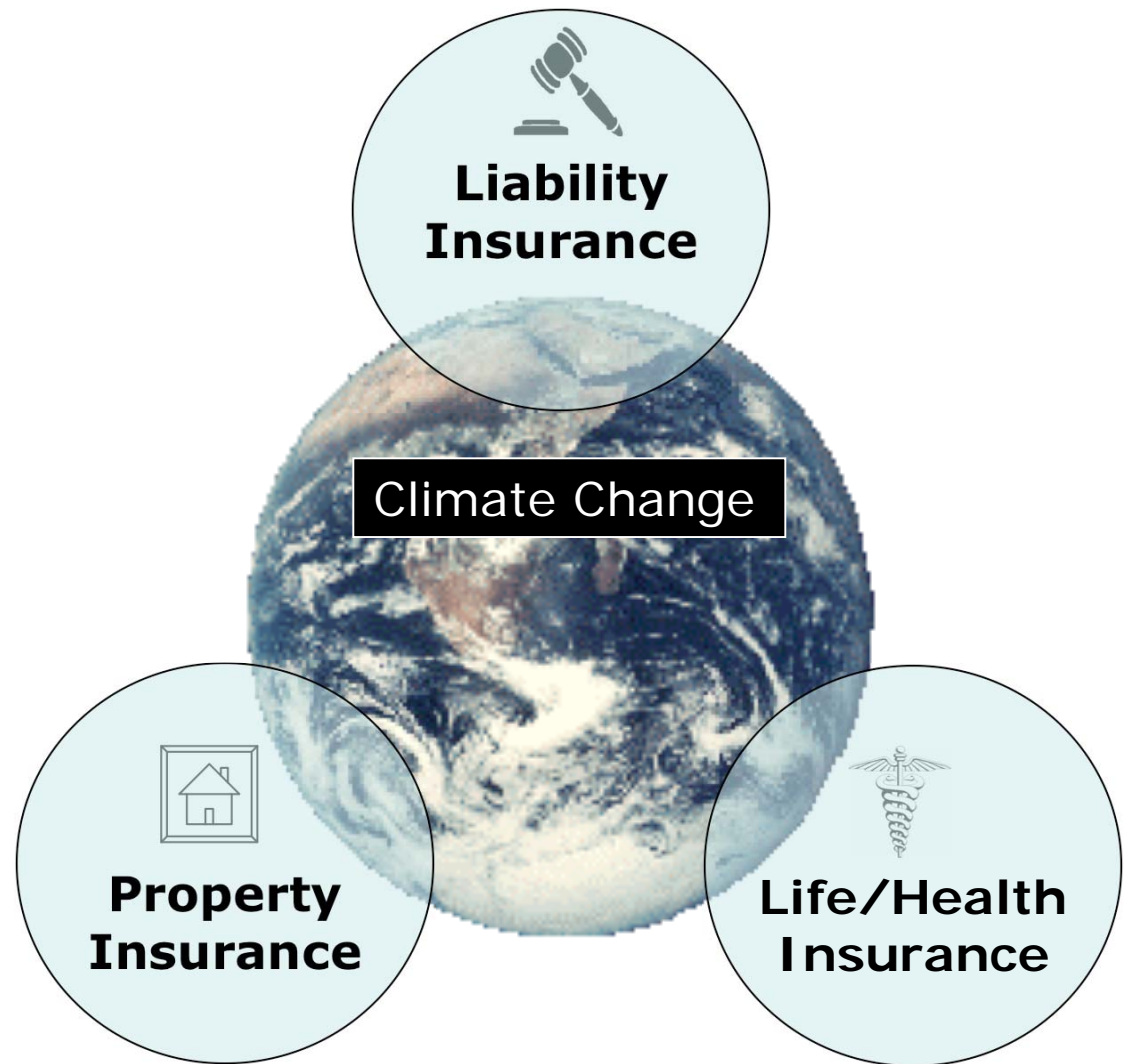


Source: Swiss Re, Sigma

Climate Change: Intersection with insurance

Insurers are....

- integrators
- risk managers
- vulnerable
- selective
- potentially part of solution



Anticipated Losses



Property

- Property damage
- Mold/moisture
- Forest products
- Agricultural losses
- Fisheries
- Business interruption
- Roadway



Life/Health

- Injury
- Infectious diseases
- Heat stress
- Respiratory
- Pollutant releases
- Food poisoning
- Mental health
- Nutrition/water



Liability

- Products
- Negligence
- Nuisance
- Fiduciary
- Tort / BI
- Environmental
- Roadway liability insurance

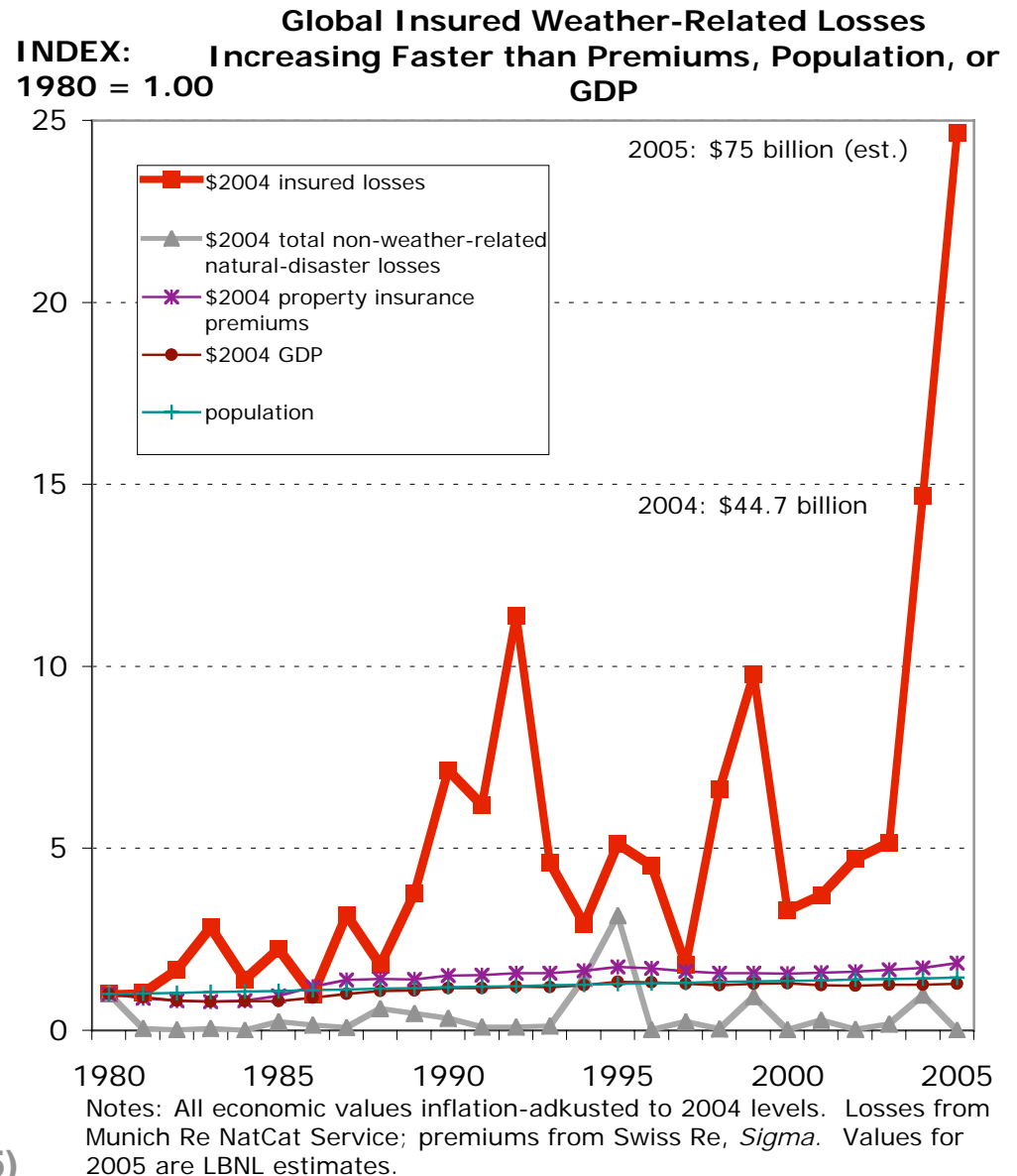
“We'd be out of our minds if we wrote weather insurance on the opinion global warming would have no effect at all.”

- Warren Buffett
2006 annual Shareholder meeting

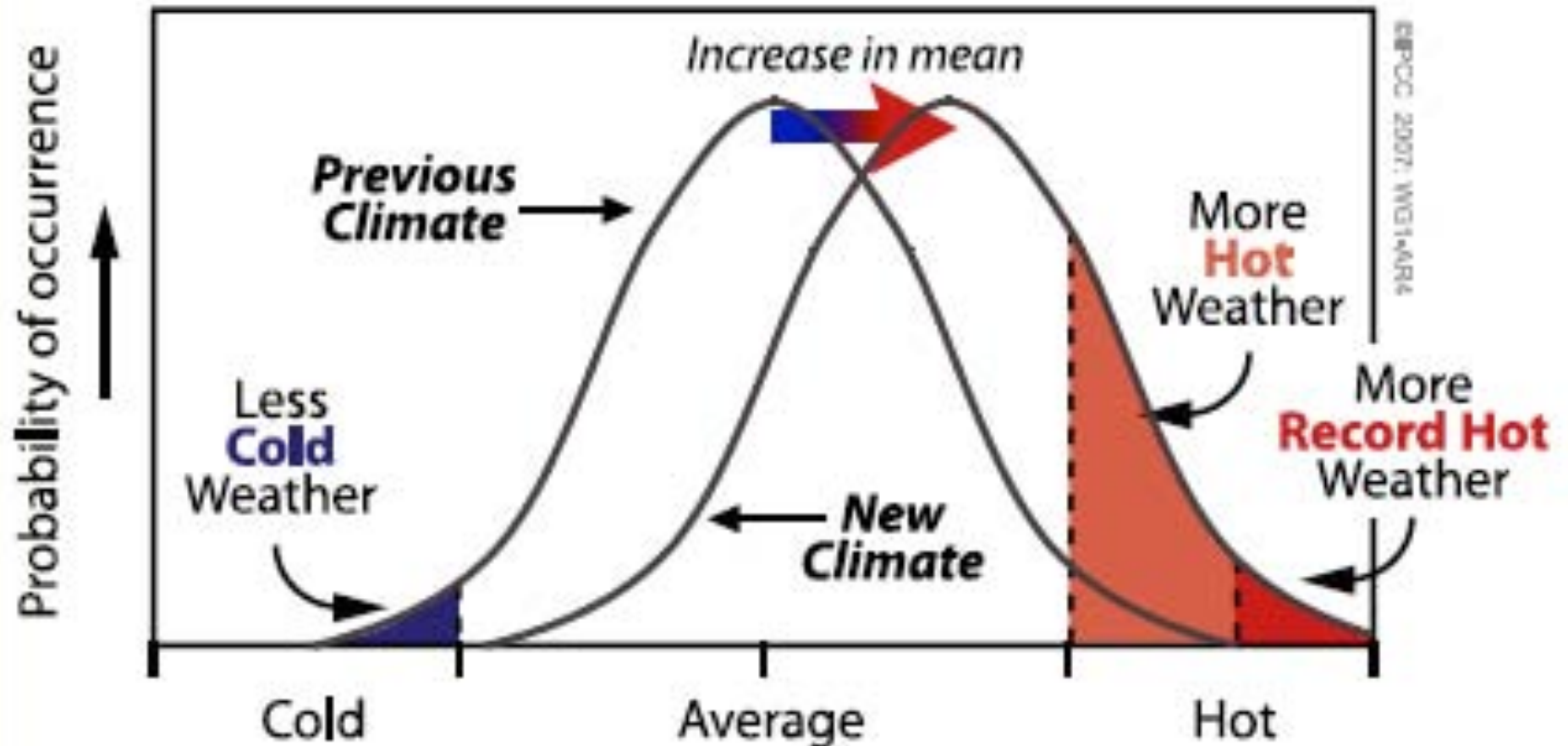
Uncertainty: Physical ➡ Financial

Non-climate factors play a role, but...

- Trends *consistent* with observed change
- Why are non-weather losses growing more slowly?
- Would have been even worse without prevention efforts

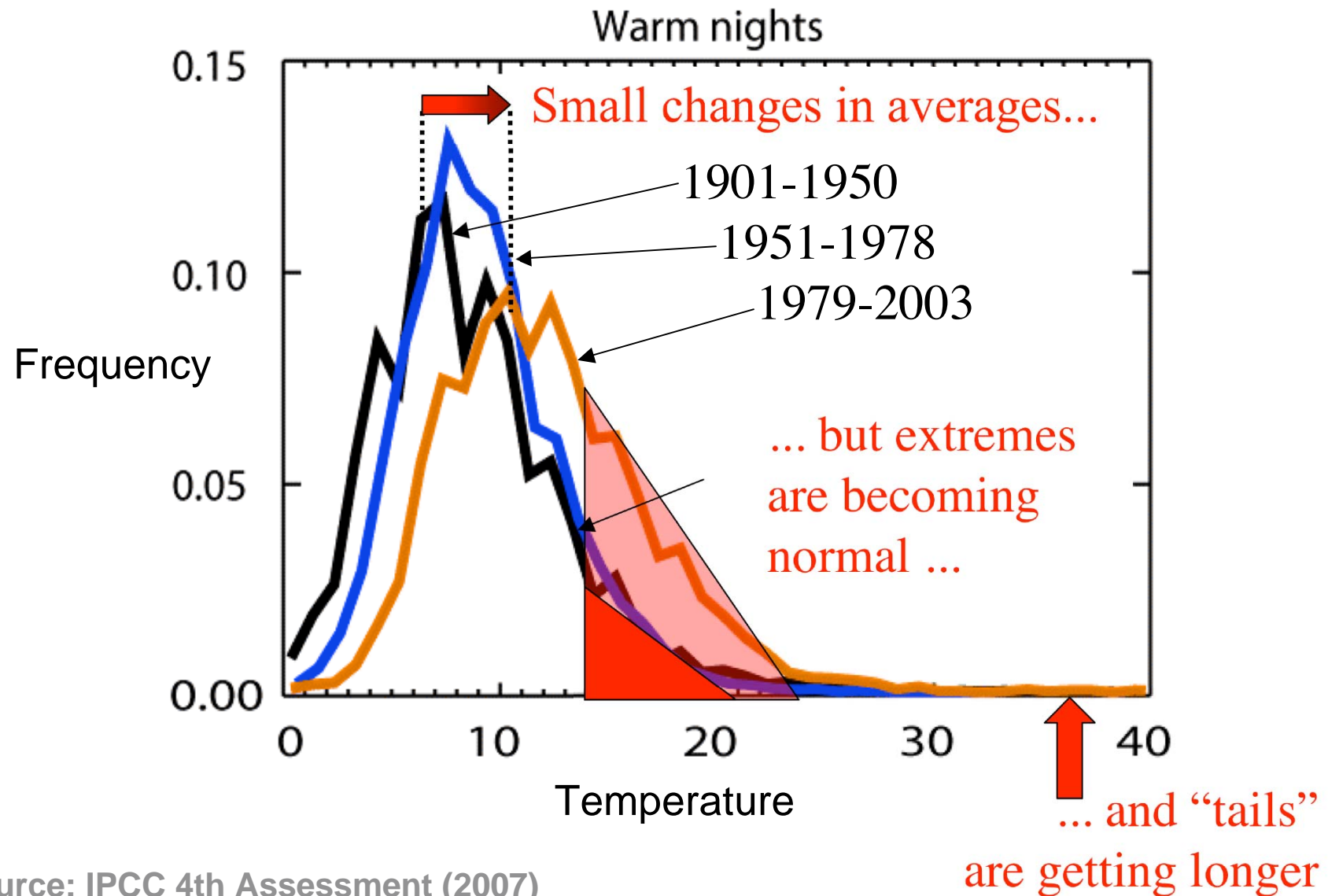


Changes in Averages vs. Extremes



Source: IPCC 3rd Assessment (2001)

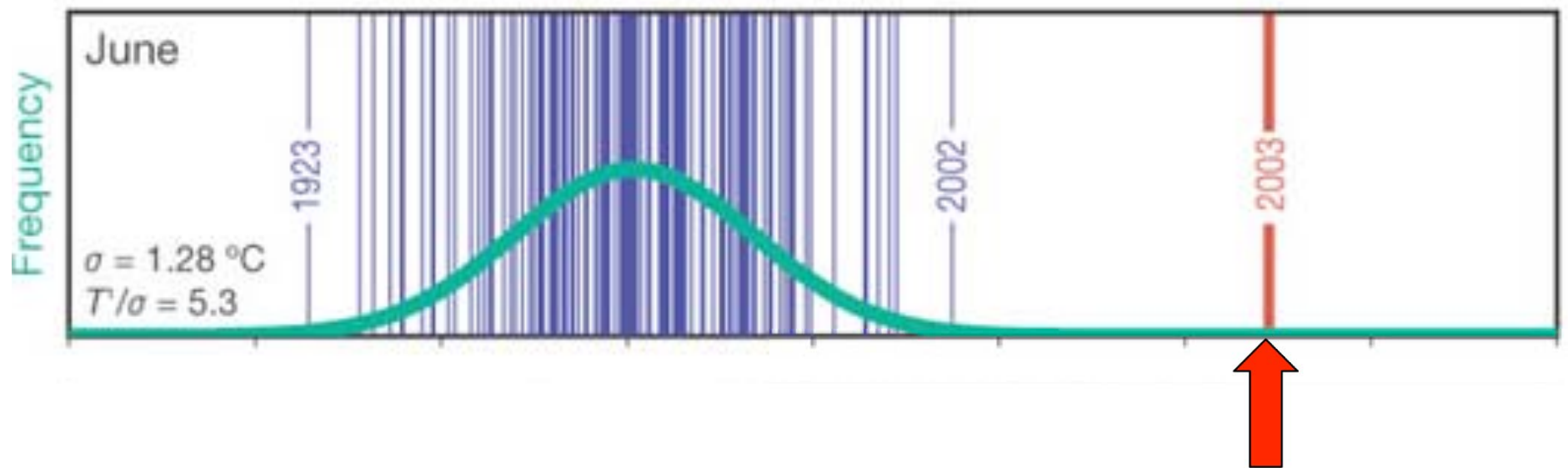
Extremes Shift *More* Than Avg's.



Source: IPCC 4th Assessment (2007)

Rare Extremes Cause Most of the Damages & Insured Losses

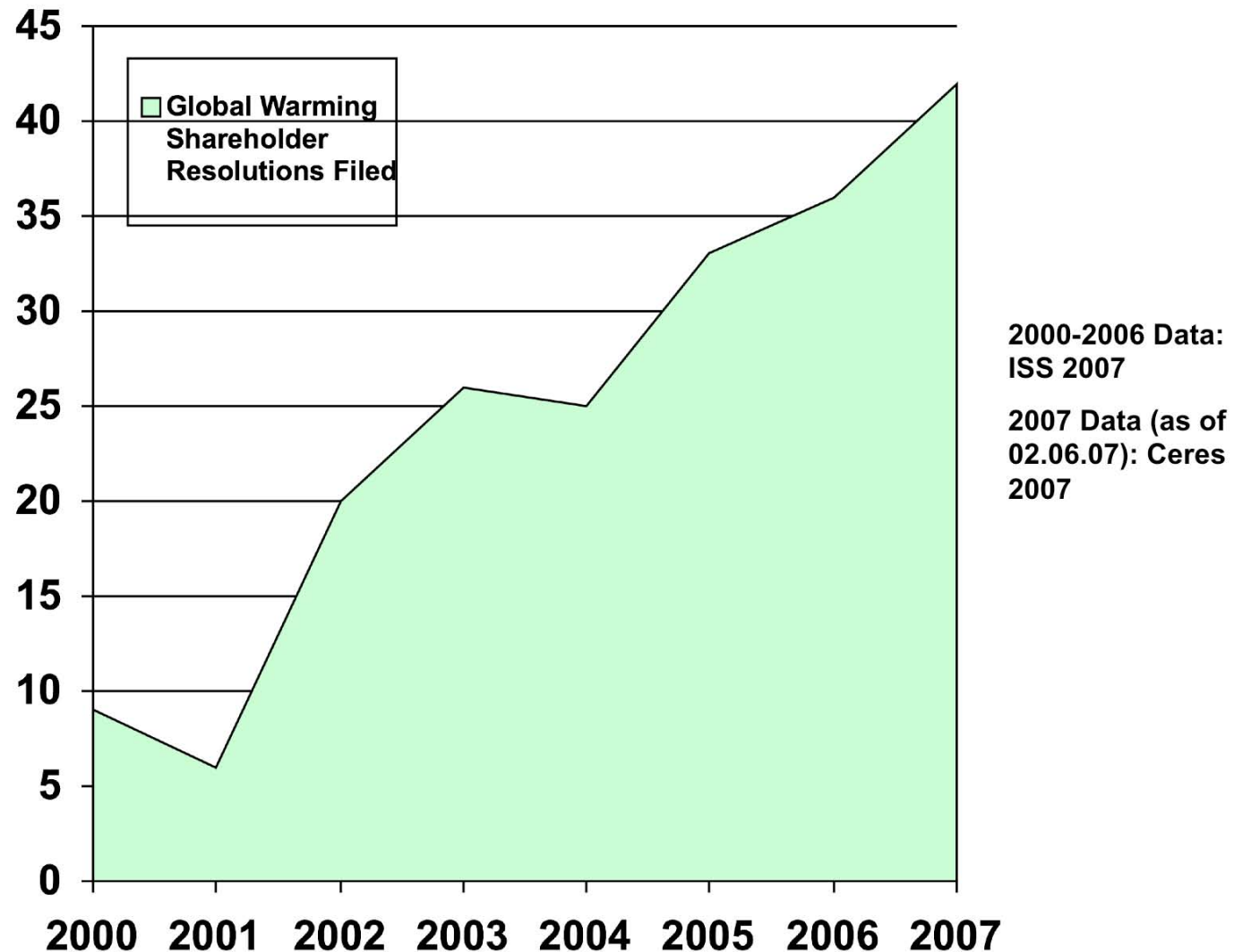
The European heat wave of Summer 2003



Event was “six-sigmas” outside of norm.
16°F above average in France and Germany
was a 1-in-10,000 event to 1-in-46,000 event

Source: Schar et al, *Nature*, v. 427, 2004.

Shareholder Resolutions Link Business Atmosphere to Climate Change Liability



www.bestreview.com

August 2007

BEST'S REVIEW

Monthly Insurance News Magazine

Insurers • Agents & Brokers • Reinsurers

D&O Heats Up

Climate change—a rapidly emerging insurance risk—has reached the world's boardrooms.

PAGE 24

A.M. Best's Exclusive Rankings:
Reinsurers, Reinsurance
Brokers—2006

PAGES 59, 65

Leading U.S. Property/Casualty
Writers by Line—2006

PAGE 31

National Underwriter

THE LEADER IN PROPERTY & CASUALTY NEWS

JUNE 25, 2007
VOL. 111, NO. 25
\$5.00

LAST CALL!



Award Entries
Due By July 6
See Page 3

TOP STORIES OF THE WEEK

Bush Opposition Leaves TRIA Extension In Doubt

The White House threw cold water on legislation providing a long-term extension of the Terrorism Risk Insurance Act, while small insurers voiced concern over mandatory coverage for all types of attacks. ▶ Page 6

State Regulator Cleared For Private NAIC Sessions

In the first ruling of its kind, North Dakota's attorney general has upheld the legality of the nation's insurance regulators barring the public from certain meetings of their national association. ▶ Page 8

Katrina Battle Heats Up

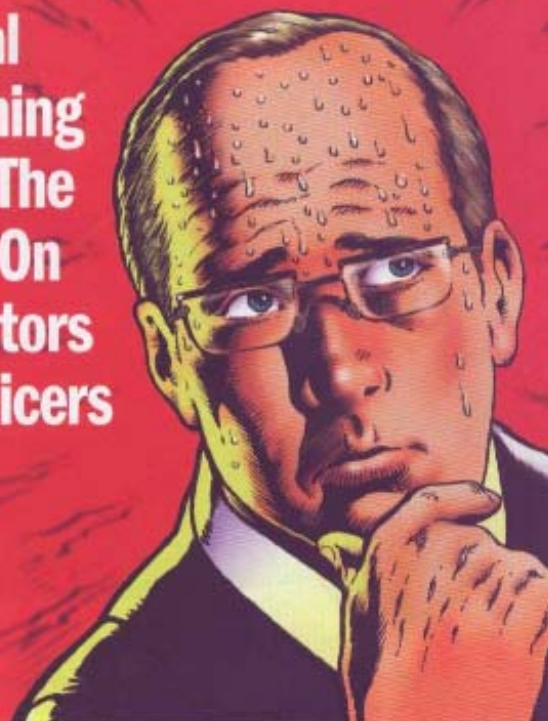
The legal battle between a major insurer and a high-profile plaintiff attorney over Katrina claims expanded on three new fronts. ▶ Page 10

'Woman Of The Year' Offers Career Advice

APIW's 2007 "Insurance Woman of the Year," H. Elizabeth Mitchell, president of Platinum Underwriters Re, shares some of the secrets of her success for those trying to make it in the industry. ▶ Page 30

Global Warming Puts The Heat On Directors & Officers

See Page 12



*****AUTO**3-DIGIT 947

PC 1538793 P 11125 PER
EWMN MILLS
LAWRENCE BERKELEY NATL LAB

00793
06712

FRAUD ALERT

FRAUD REVIEW
Insurers Go Hi-Tech To Combat Crooks

ROGUE AGENTS!
Dishonest Producers Play Shell Games With Their Clients

Business Insurance

February 5, 2007

www.businessinsurance.com

**ANOTHER APPEALS COURT
RULES CASH BALANCE PLANS
DON'T DISCRIMINATE / PAGE 3**

**FINANCIAL GUARANTEE INSURER
PAYS \$75 MILLION TO SETTLE
FINITE CHARGES / PAGE 3**

**RADIO STATION RISK MANAGERS
TO INCREASE ON-AIR OVERSIGHT
AFTER CONTEST TRAGEDY / PAGE 3**

In Brief

**Mich. court rejects
same-sex benefits**

Michigan's 2004 marriage amendment prohibits public employers in the state from offering health benefits to employees' same-sex domestic partners. The Michigan Court of Appeals says, by a 3-2 vote, that it dismissed last week in *Anderson v. City of Ann Arbor*, a lawsuit by the City of Ann Arbor, a three-judge panel held that public employers and that recognize domestic partnership agreements for the purpose of providing benefits "infringe substantially on the free language of the amendment."

**Bias claims up
in 2006: EEOC**

A total of 75,768 discrimination charges were filed with the U.S. Equal Employment Opportunity Commission in fiscal year 2006.

See IN BRIEF page 2

U.N. climate report stirs liability fears

*Scientific testimony
may fuel lawsuits
on global warming*

By ROBERTO CENICEROS

The publication of a U.N. report last week linking human activity to global warming could be enough to cause immediate liability problems for industrial companies, but it does increase the chances of more claims "filtering through to insurance policies in the future," some experts say.

The report, which links the burning of fossil fuels with more extreme climate conditions, may increase the likelihood that commercial policyholders and their liability insurers will have to fund more defenses against alleged

climate-related liability claims. It also claims that global warming played a role in causing Hurricane Katrina, which damaged the homeowners' properties.

The lawsuit, which everybody brought to light, got thrown out and didn't represent a threat that stress the law, "for policyholders responsible liability for global warming-related losses," said David Delischi, president of American Risk Management Resources Network LLC, a Madison, Wis.-based environmental wholesale brokerage.

In addition, last year, then California Attorney General Bill Lockyer sued several Japanese and U.S. auto manufacturers and U.S. auto manufacturers said G. Andrew Lundberg, a policyholder attorney at Litman & Watkins LLP in Los Angeles,

the lawsuit alleged that the

Marsh reaps \$3.9B with Putnam deal

*Investment firm sale
will sharpen focus,
boosts war chest*

By SALLY ROBERTS

NEW YORK—Marsh Inc. is announcing the sale of Putnam Investments, its investment management unit, to a consortium of buyers, which will make the 100-year-old company more focused, analysts say.

Marsh, a New York-based insurance broker, is selling Putnam, a New York-based investment management firm, to a consortium of buyers, which will make the 100-year-old company more focused, analysts say. Marsh is selling Putnam, a New York-based investment management firm, to a consortium of buyers, which will make the 100-year-old company more focused, analysts say.

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THE INFORMED READER

A survey of insights from media around the world.

[< Why Do Teens Act That Way? They Have No \[...\] -- PREVIOUS](#) | [SEE ALL POSTS FROM THIS BLOG](#)

June 3, 2007, 5:13 pm

What Insurers Should Do About Climate Change



Getty Images

Insurers are likely to soon take a leadership role in reducing the risks of climate change as companies become more liable for damage related to it. The authors of a study jointly published by the [Stanford Environmental Law Journal](#) and the [Stanford Journal of International Law](#) sketch out several ways that companies who disproportionately contribute to global warming could be held responsible for its damage as the science of global warming becomes clearer.

The most common example is owners of property damaged by a warmer world's extreme weather suing companies that disproportionately emitted greenhouse gases. As well as paying out on insurance covering such liability claims, insurers will have to pay for several kinds of damage related to global warming, the authors say. They'll have to pay for car crashes on wet roads and ski resorts that insure themselves against warm winters short on snow.

"The insurance industry, perhaps more than any other institution, has the power to set the stage for enduring and significant contributions to solving the problem of global climate change," say environmental consultant Christina Ross, government scientist Evan Mills and environmental-law expert Sean B. Hecht.

Considerations for Utilities

[insurance, self-insurance, reinsurance]

- **Infrastructure repair, redesign, fortification** [property]
- **Service provision & lost revenues**
 - Changes in demand for energy and water
 - Failure to deliver [contingent business interruption]
 - Eroded water quality [product liability]
- **Liability**
 - As providers of services [general liability]
 - As emitters [various liability]
 - As impacted businesses [directors and officers liability]
- **Reputation**
 - Part of problem or solution?
 - Preparedness in the eyes of public, customers, shareholders, regulators
- **Risk profiles of climate responses**
- **Insurance availability & affordability**

Availability & Affordability

- Exodus of insurers from coasts (*and* elsewhere)
- Quiet “hollowing out” of insurance
- Customers “going Bare”: 9 utilities (10% of membership) left in OIL Mutual Ins. Co. May 2007
 - Paid \$100 million in fees to leave
 - CEO says “It was a stunning blow”
- Rand Report on commercial insurance in FL
 - In 2005: one insured paid \$250k for \$38m coverage
 - In 2006: paid \$940k for \$5m coverage, i.e. a ~29-fold bump in the “cost of risk”

Physical Impacts to Watch For

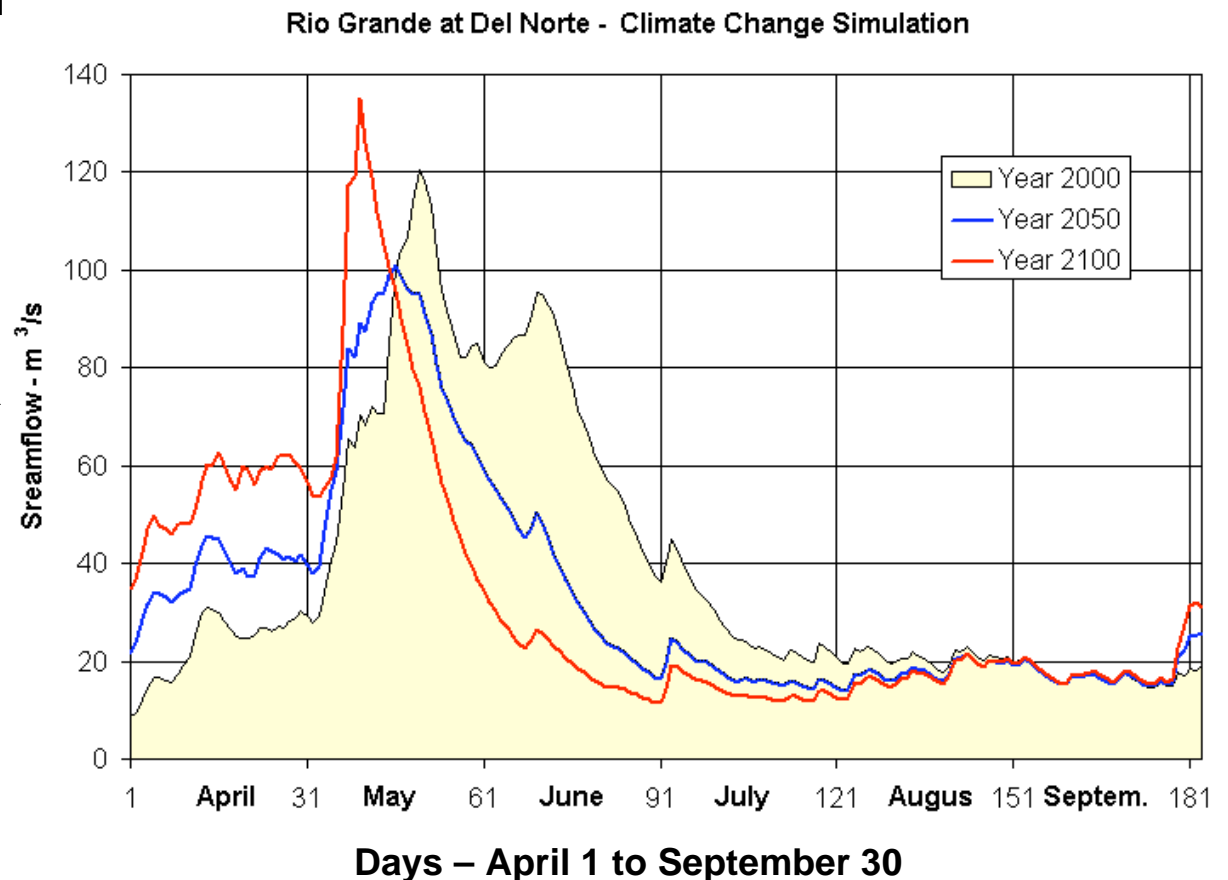
- **Elevated temperatures** - peak demand (water & energy); increased T&D (“I²R”) losses; loss of cooling water; erosion of water quality; increased evaporation
- **Sea level rise** - infrastructure inundation; corrosion; wastewater; salt-water intrusion into drinking water
- **Reduced lake levels** - hydro output; water avail./qual.
- **Storm -- Precipitation, flood, lightning** - infrastructure damage & power outages; siltation of reservoirs; water quality (turbidity, nutrients, pathogens, toxins, algal blooms, bacteria, acidification, fertilizers and pesticides)
- **Drought** - reduced hydro output; water supply-demand; water quality (reduced dilution, increased salinity)
- **Subsidence & permafrost melt** - damaged pipelines, generators; transmission networks; groundwater quality

Climatic Shifts in Hydrograph

Fingerprints

- Percent of precipitation falling as rain (vs snow) increased at 74% of U.S. stations
- April snow equivalent down 15-30% in western North America
- Stream-flow peaking 1-4 weeks earlier (western US mountains)
- Earlier river-ice breakup

Forecasts



Source: Brian H. Hurd

Dept of Agricultural Economics and Agricultural Business, New Mexico State University

Tanzania: Drought >> Blackouts

1990



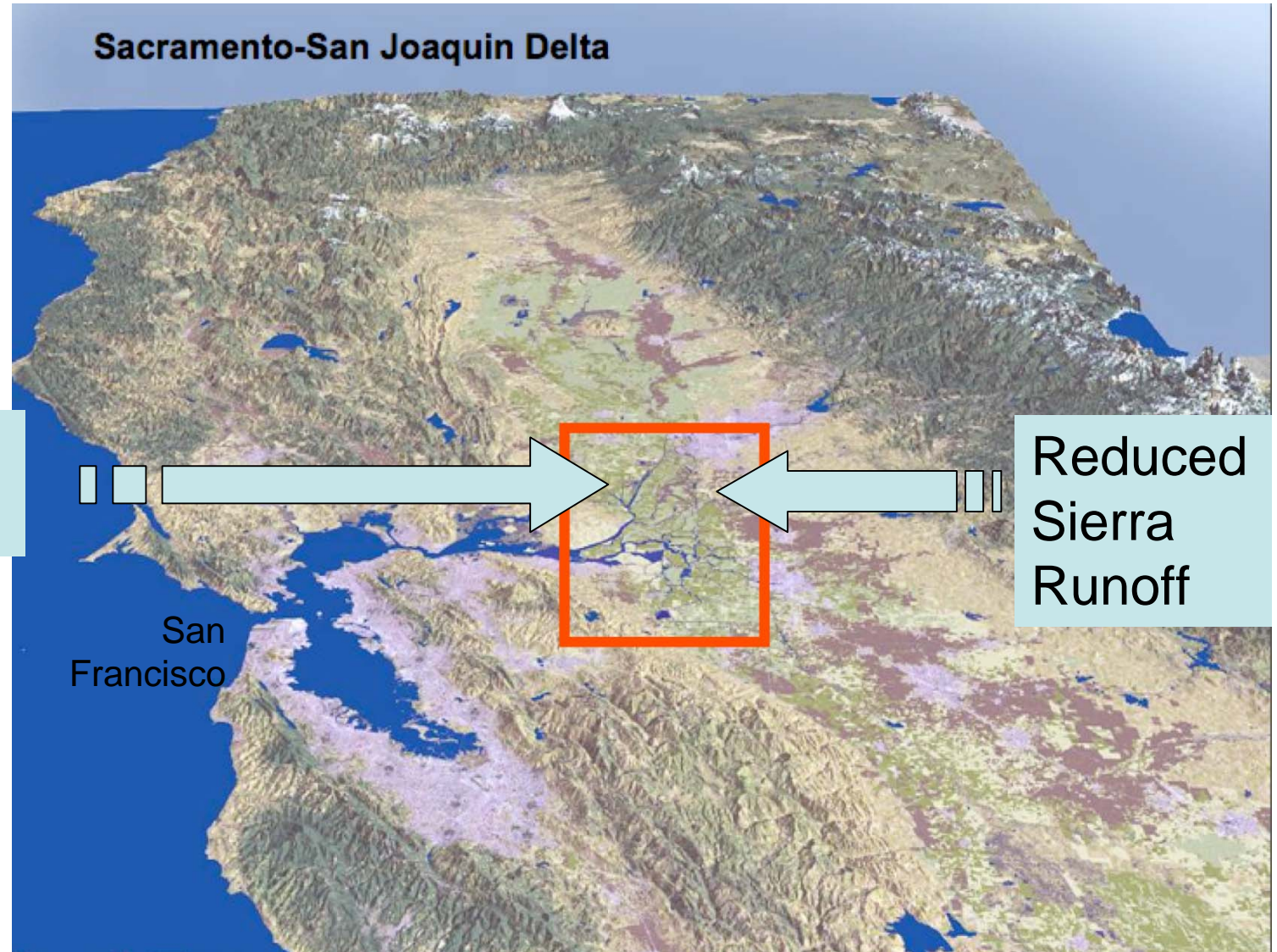
Mt. Kilimanjaro

2000



Water Quality: California

CALIFORNIA
www.50states.com

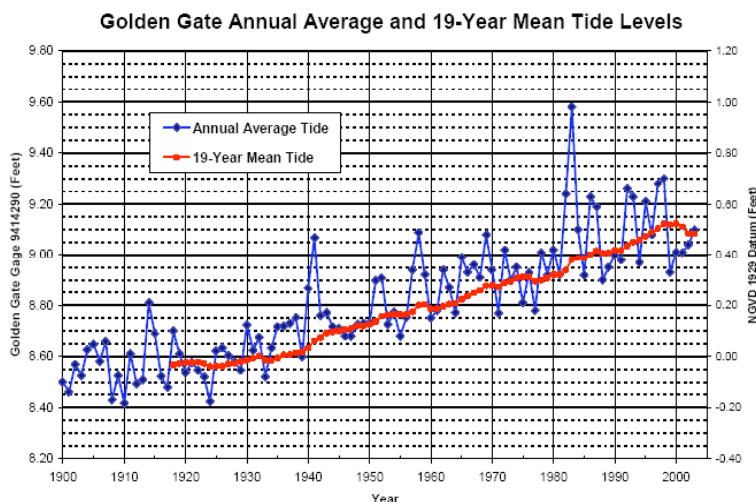


Sea-level
Rise

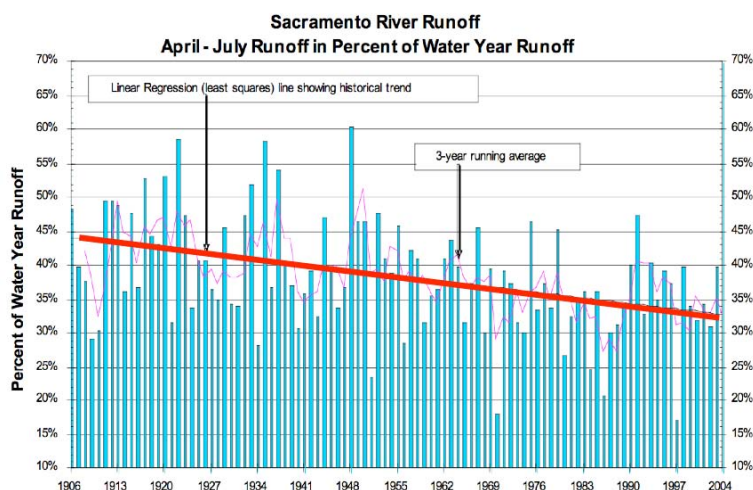
Reduced
Sierra
Runoff

Rising Salinity

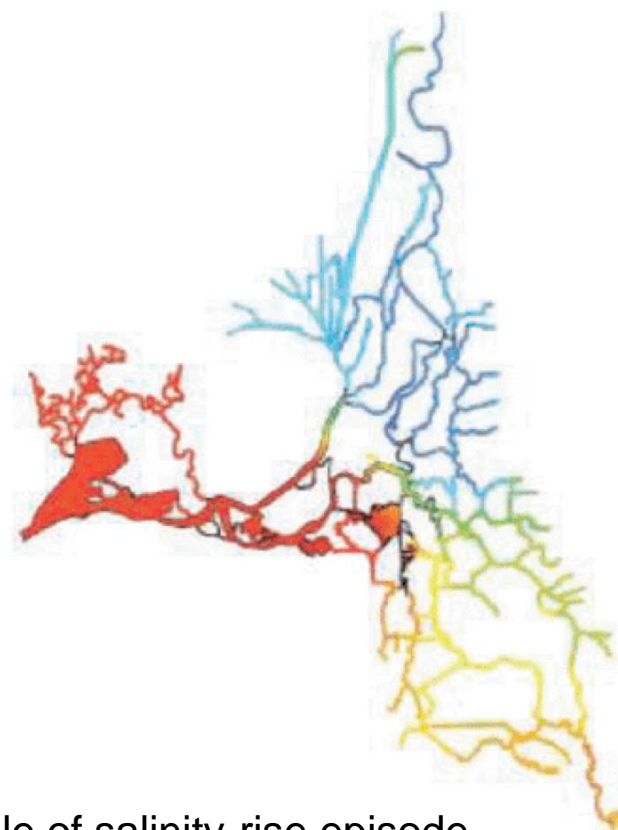
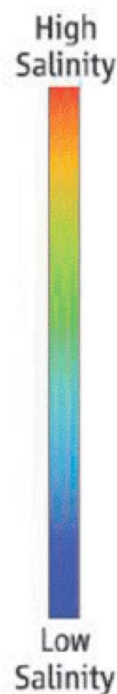
Sea-level Rise



Reduced Runoff

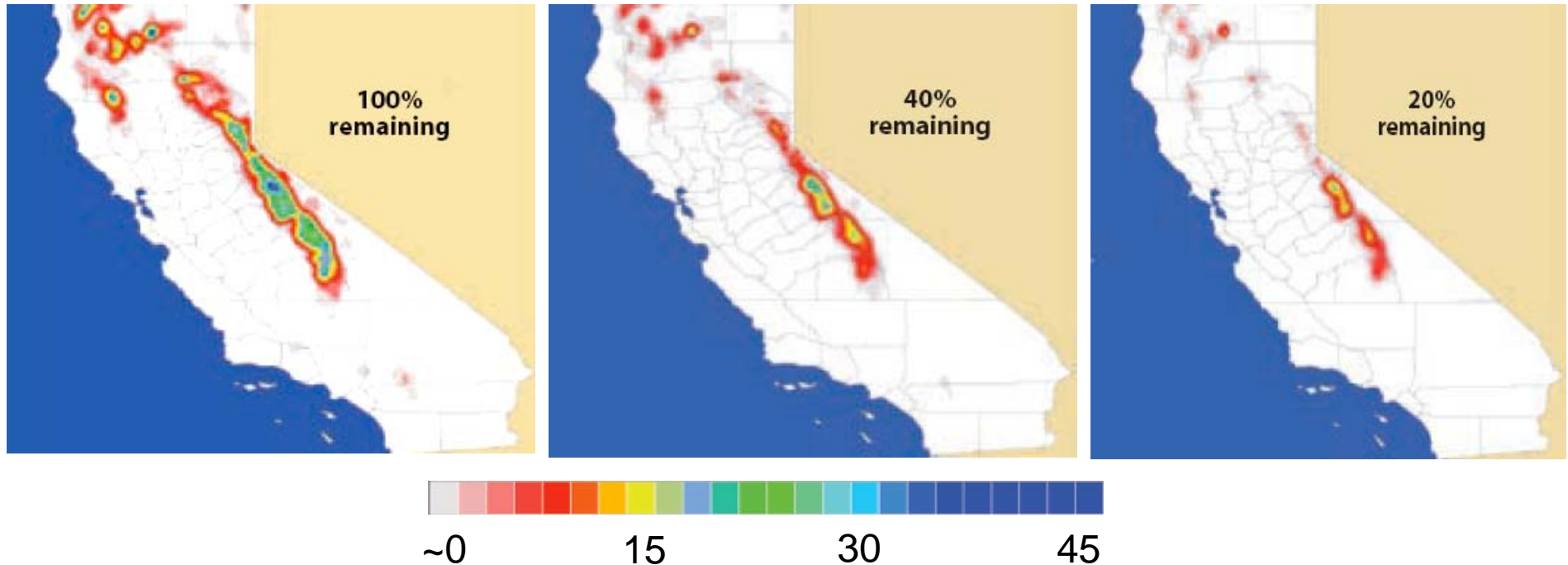
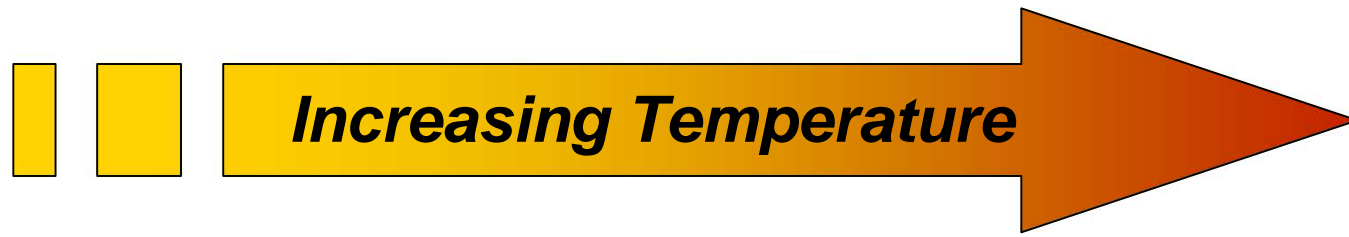


Salt Water Intrusion (California Delta)



Example of salinity-rise episode during drought of 1992 (*Science* 2007)

Forecast Decrease in Sierra Nevada Snowmelt



April 1 snow water equivalent (inches)

Hayhoe et al. "Emissions pathways, climate change, and impacts on California", *PNAS* (2004)

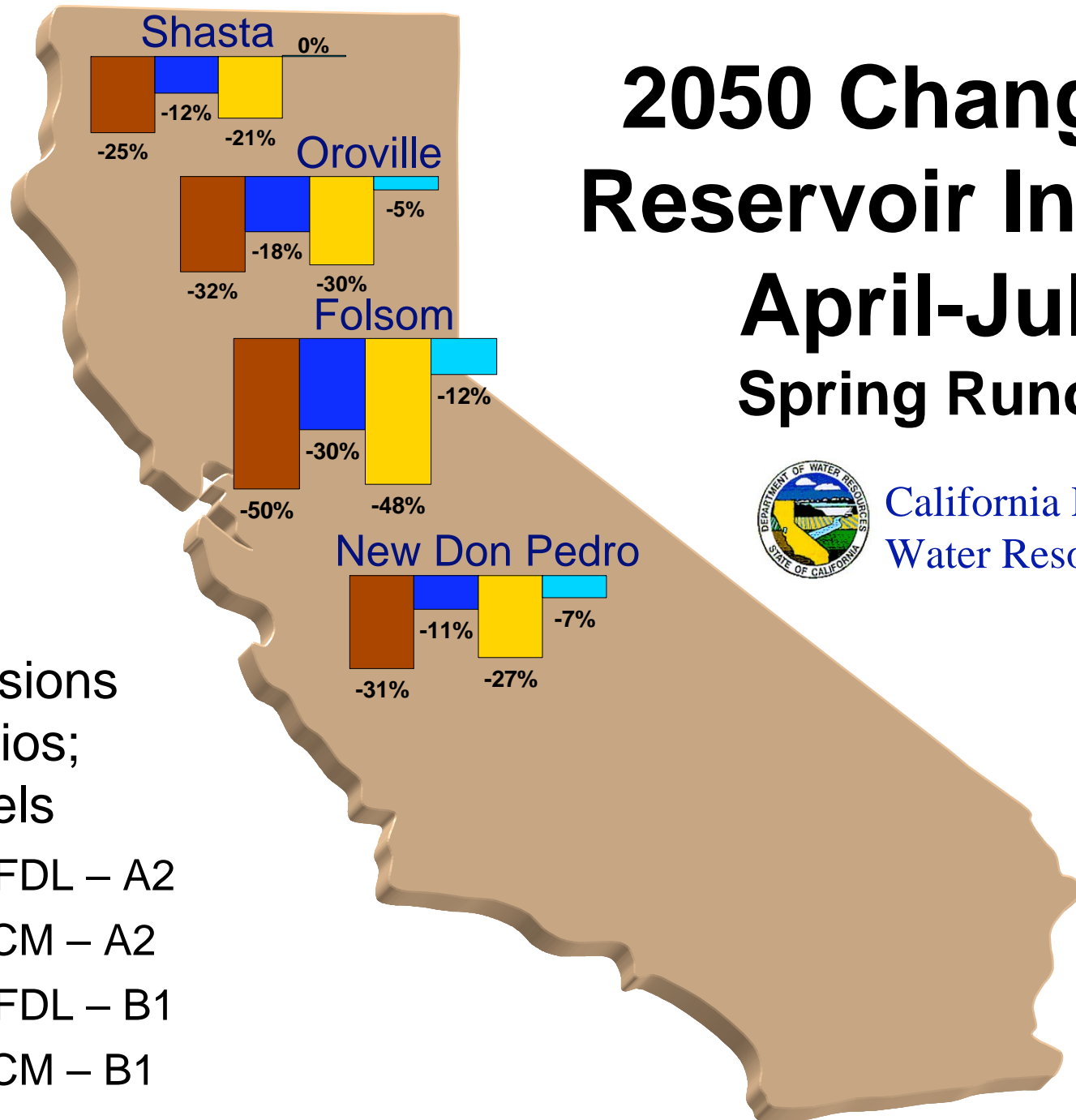
2050 Change in Reservoir Inflows

April-July Spring Runoff



California Department of
Water Resources

2 emissions
scenarios;
2 models



Sea-level Rise = 10 feet = half of Greenland melting



(Source:
Harvard University)

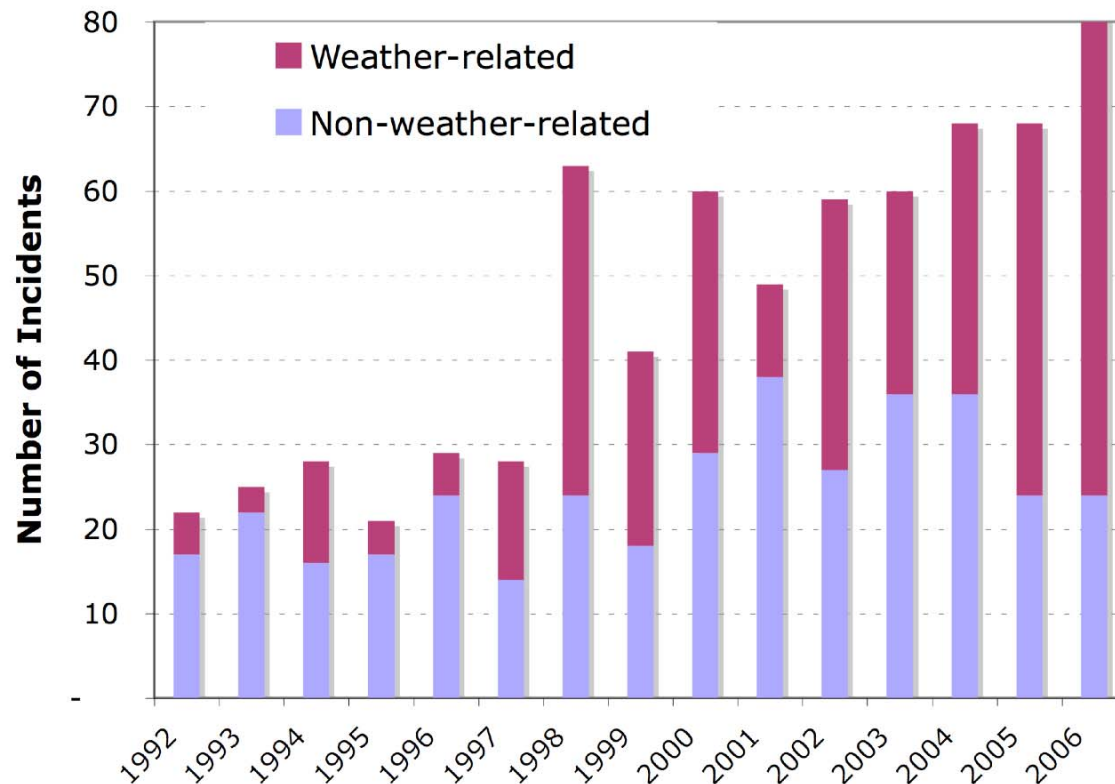
Sea-level Rise = 10 feet = half of Greenland melting



(Source:
Harvard University)

U.S. Power Outages

US Electric Grid Disturbances (1992-2006)
Weather- and Non-Weather-Related
110 million customers effected



Source: US Department of Energy

U.S. economy total cost:
~\$80B/year

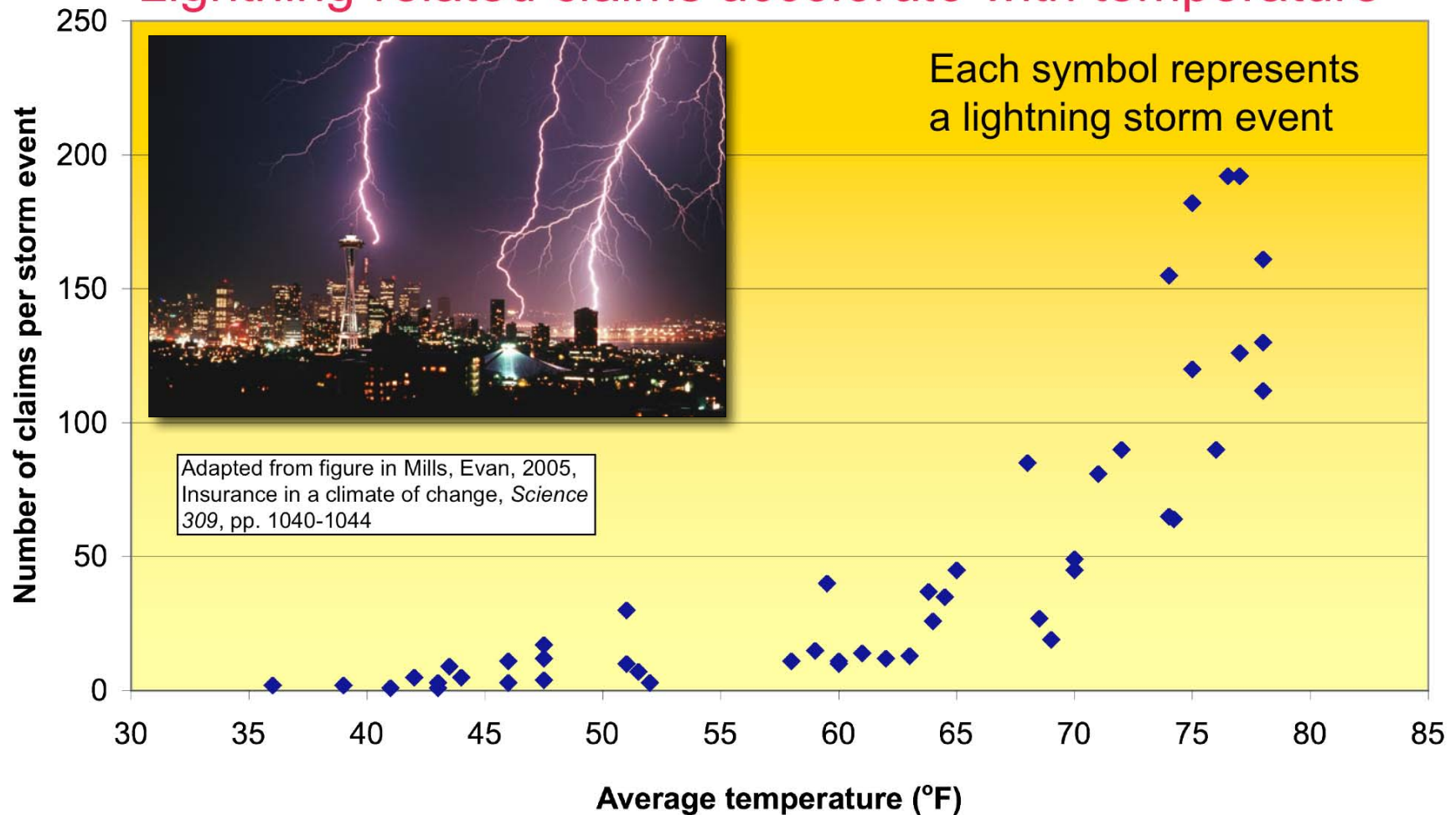
Average cost to utilities
\$49 million/storm; max.
\$890 million (EEI)

RMS Scenario:
\$2.7B for NY

**Power outages were a factor in slowness of draining
New Orleans following Hurricane Katrina.**

Temperature-Related Insurance Loss Experience

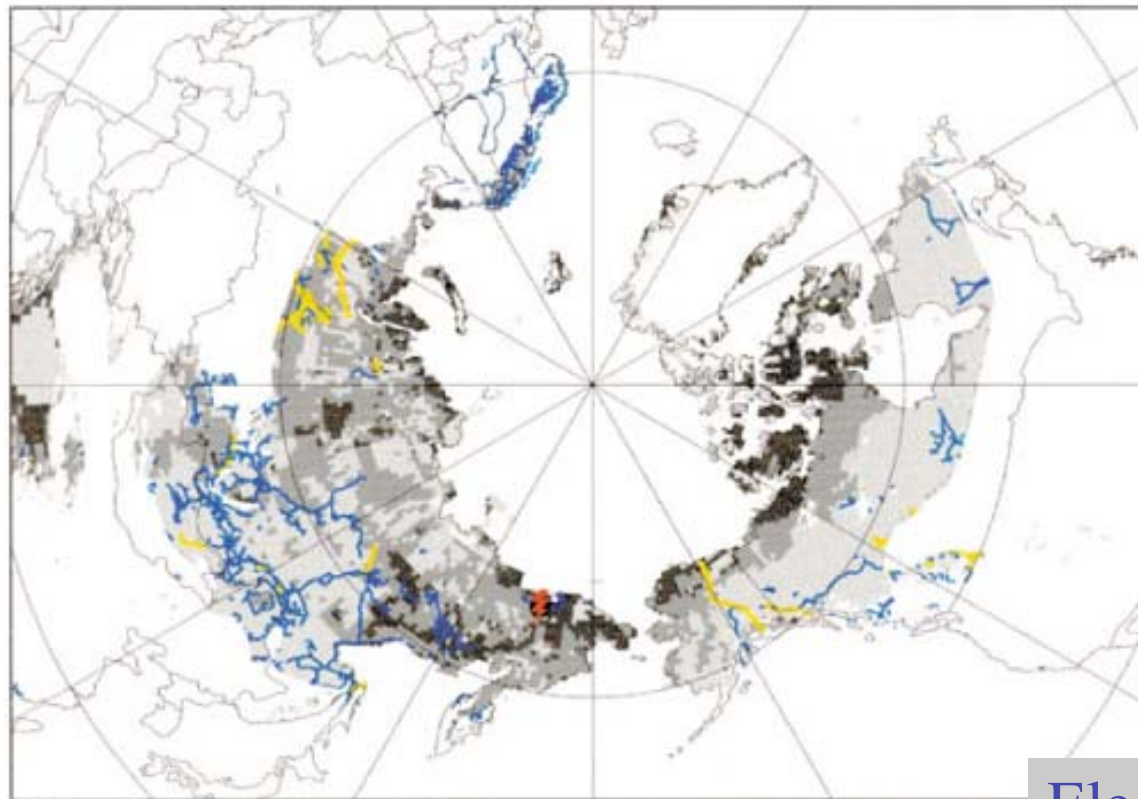
Lightning-related claims *accelerate* with temperature



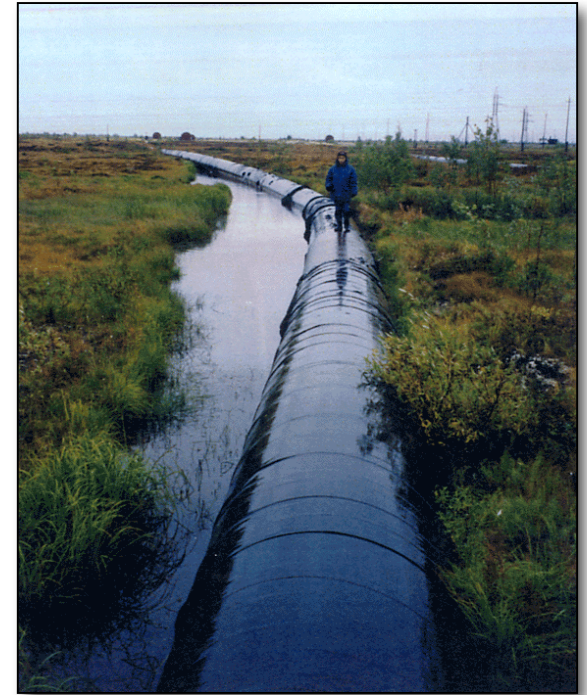
Source: Hartford Steam Boiler Inspection and Insurance Co.

Permafrost Melt Hazard Potential

Settlement of *several meters* is possible



Stable Low risk Moderate risk High risk



Electrical transmission
Pipelines
Bilbino nuclear station

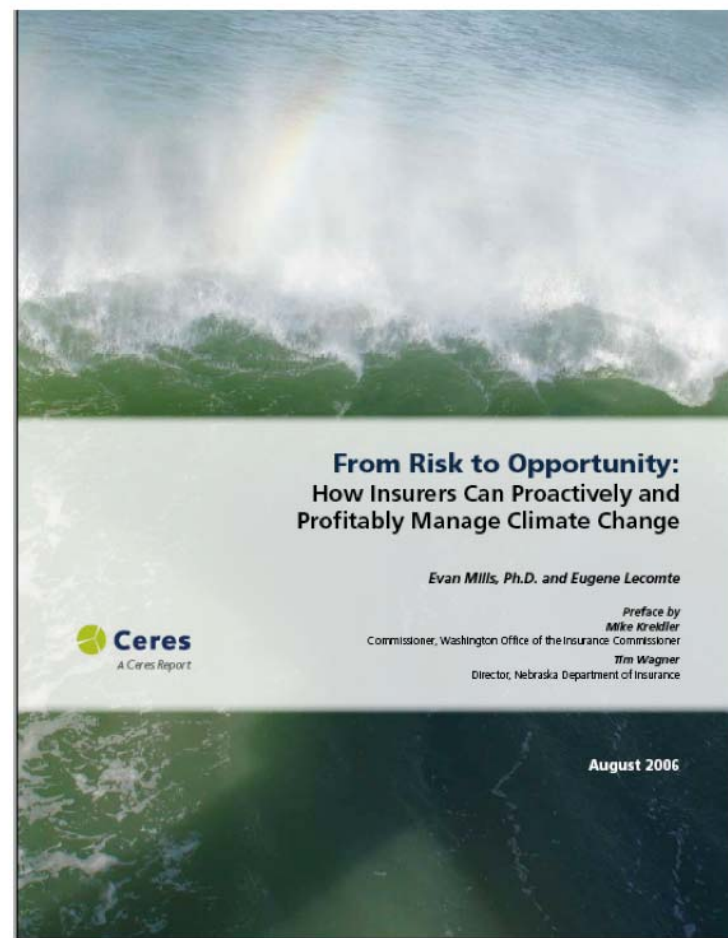
Managing Risks & Capturing Opportunities

From Risk ... to Opportunity

*The insurance sector has a key role to play in **helping to mitigate the effects** of climate change ... and by **developing new products and solutions** that can support emerging greenhouse-gas and renewable energy markets.*

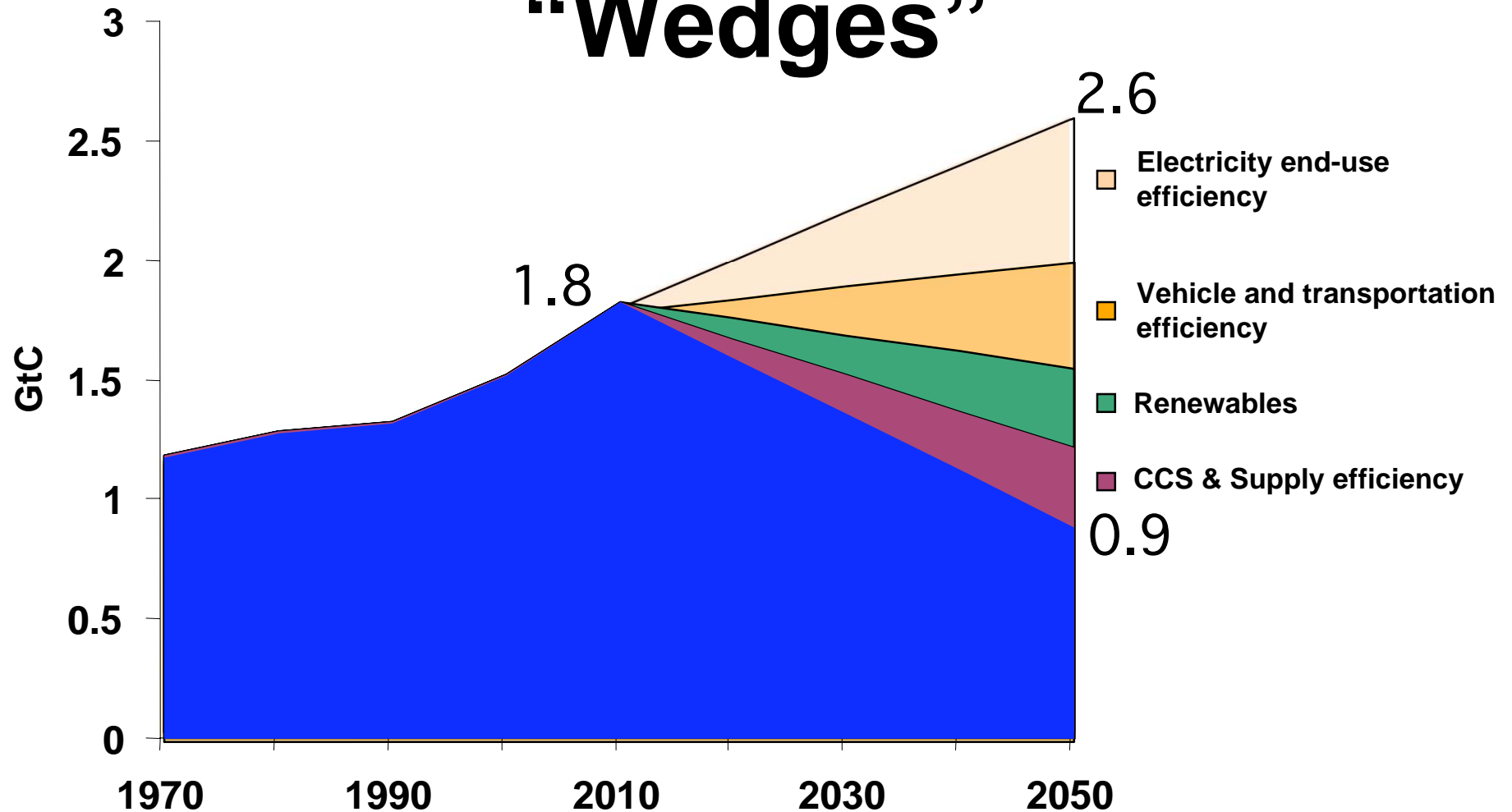
- Marsh & McLennan

Ceres Report: 25 strategies;
~220 examples; ~120 insurers



Cutting U.S. Emissions in Half with Climate-Stabalization

“Wedges”



After Pacala and Socolow (*Science*)

More Business!



The strength, experience and flexibility to protect business against risk.

PROPERTY | CASUALTY | PROFESSIONAL | SPECIALTY

The XL Insurance Companies are the world's leading firms not only for the strength of our capital and the depth of our experience, but also for the quality and variety of our products.

PROPERTY
 General All Risk | Property Damage & Business Interruption | Energy & Construction All Risk | Fine Art | Ocean In Transit

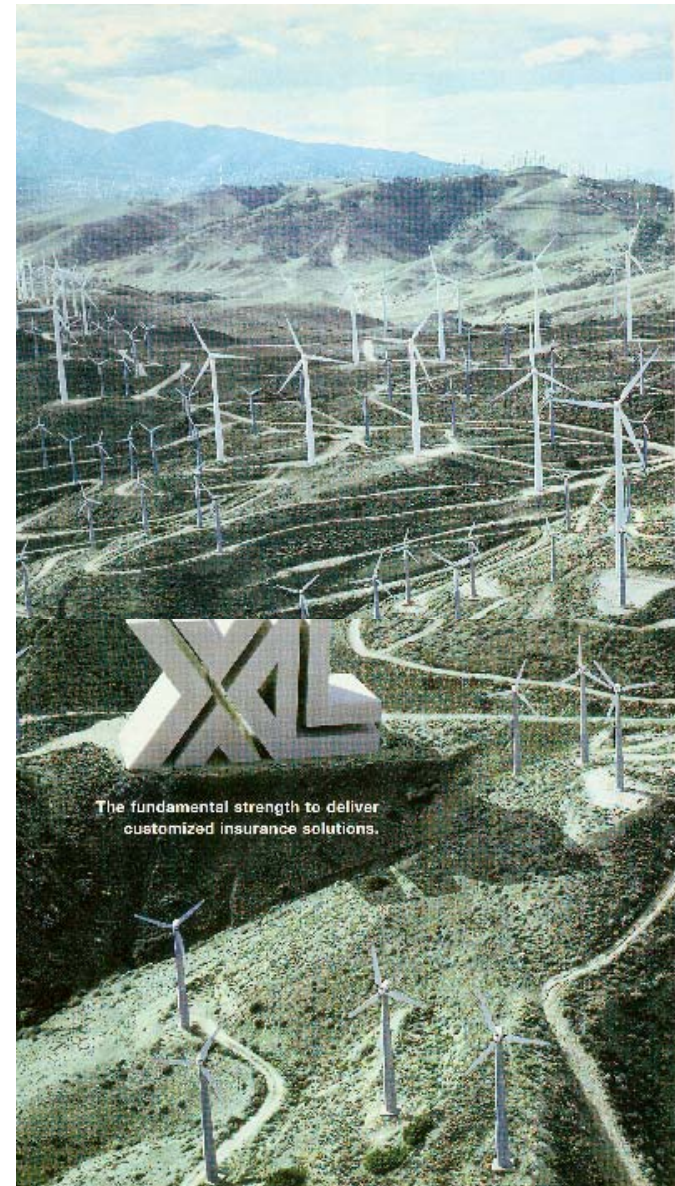
CASUALTY
 Primary Liability | Global Public & Products Liability | Automobile Liability | Umbrella & Excess Liability

PROFESSIONAL
 Directors & Officers | Employment Practices Liability | Errors & Omissions

SPECIALTY
 Aviation & Space | Environmental Liability | Marine | Perils & Marine Cargo | Programs

people, providing tailored solutions and services to meet your individual insurance requirements. If you expect more, visit www.xlinsurance.com or call us toll-free: 800-608-2510.

XL INSURANCE
 FUNDAMENTAL STRENGTH - CAPTURING PEOPLE



The fundamental strength to deliver customized insurance solutions.

XL INSURANCE
 FUNDAMENTAL STRENGTH - CAPTURING PEOPLE

Promoting Loss Prevention

- *Institute for Business and Home Safety's* “Fortified... for safer living” stds.
 - Wind-resistant rigid foam panel walls and multi-glazed windows
 - Ice-dam resistant
 - Mold resistant
 - Water-resistant insulation

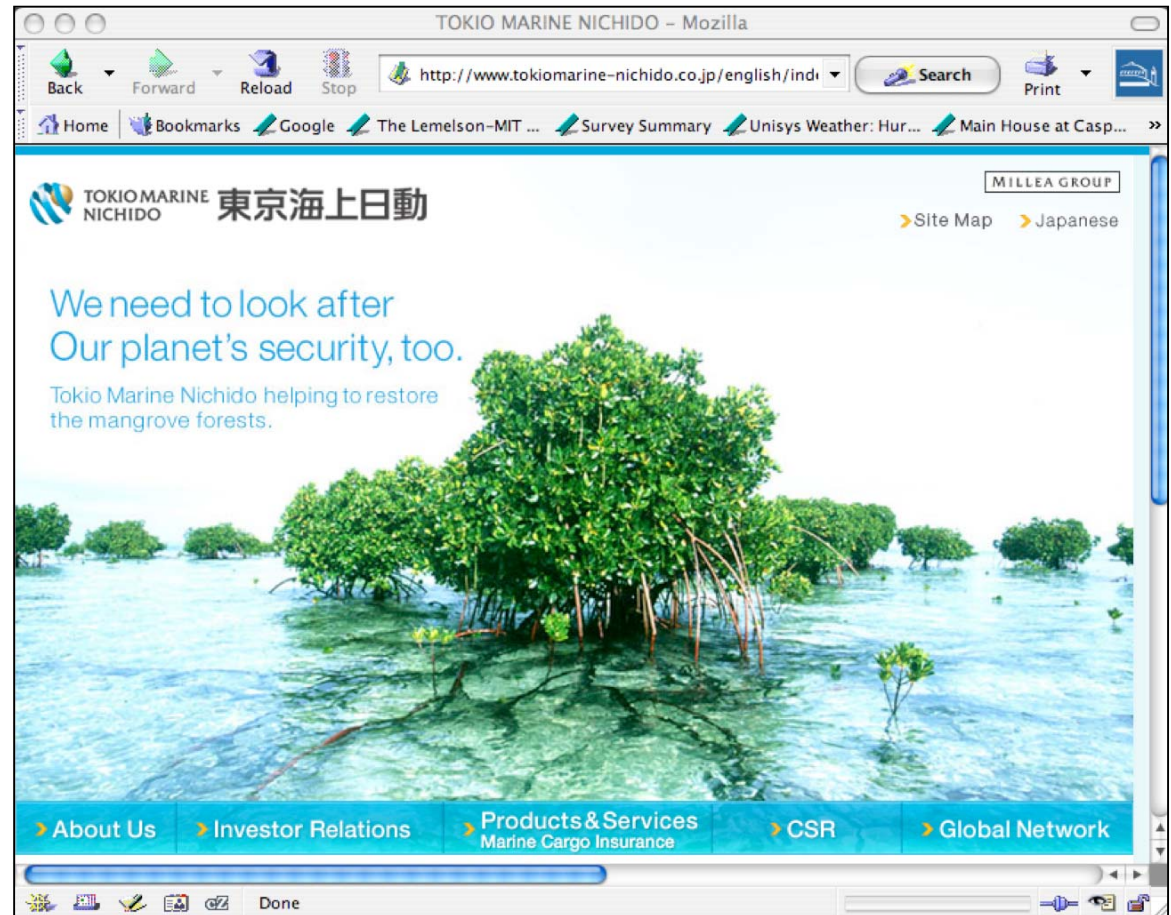


BASF Home - Patterson NJ

*Some insurers are giving premium credits...,
why not combine with utility rebates??*

Financing Solutions

- ***Tokio Marine & Nichido*** has reforested 7,500 acres of mangroves in Indonesia, Thailand, Philippines, Myanmar and Vietnam. 5,000 more acres in progress



Source: <http://www.tokiomarine-nichido.co.jp/english/index.html>

Crafting Innovative Insurance Products

- ***Fireman's Fund***: first-ever “Green-Buildings Insurance”
 - Premium credits for green features
 - Rebuild green after loss
 - Talking with utilities....
- ***Lloyds***: Energy Savings Insurance
- ***Munich Re***: geothermal performance insurance
- ***Various***: weather derivatives



Providing New Customer Services

- **Insurance Australia Group** offering on-line automobile carbon-offset service for customers

Calculate your CO₂

Offset your emissions

Take our survey

Play the game

Climate Help

Climate change


Going carbon neutral

What we're doing

How you can help

FAQ

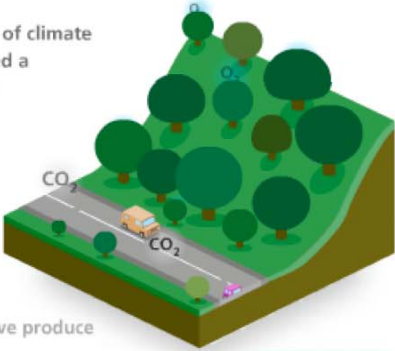
Contact



Don't underestimate the effects of climate change.

With recent events like Hurricane Katrina, persistent droughts, and worsening bushfire seasons, there are now more signs than ever that our climate is changing.


Because cars are a significant cause of climate change, NRMA Insurance has created a new environmental program called Climate Help. It shows you how to offset your car's emissions, and how to help combat climate change with a unique method called carbon credits.



CO₂ CO₂

Forests reduce the CO₂ we produce

Next »

 Climate Help
Pay for your emissions

Back to Climate Help

Paying for your emissions is one of the simplest things you can do to help the environment. And we've tried to make it even simpler by allowing you to pay online with your credit card.

It's good to know you're doing the right thing, so we can also send you a certificate confirming that your car emissions will be offset. Just check the box on the next page and we'll email it to you in PDF format.

Calculate your CO₂

Choose your car type [Need help?](#)

Small

How far do you drive each year? [Need help?](#)

Between 10,000 kms and 15,000 kms per year

Your car emits 2.1 tonnes of CO₂ emissions annually

To offset your emissions for 12 months you need to pay \$32.93*

*It costs \$15.68 to offset one tonne of CO₂

Pay for your emissions

Title

First name

Surname

Mr

Email

Age

18-24 years

Are you an NRMA Insurance customer?

Are you an IAG staff member?

Yes No

Yes No

Name on credit card

Credit card number

Expiry Date

Credit Card Type

01 / 06

Please select

We do not accept AMEX or Diners Club

You are paying \$32.93

Next »

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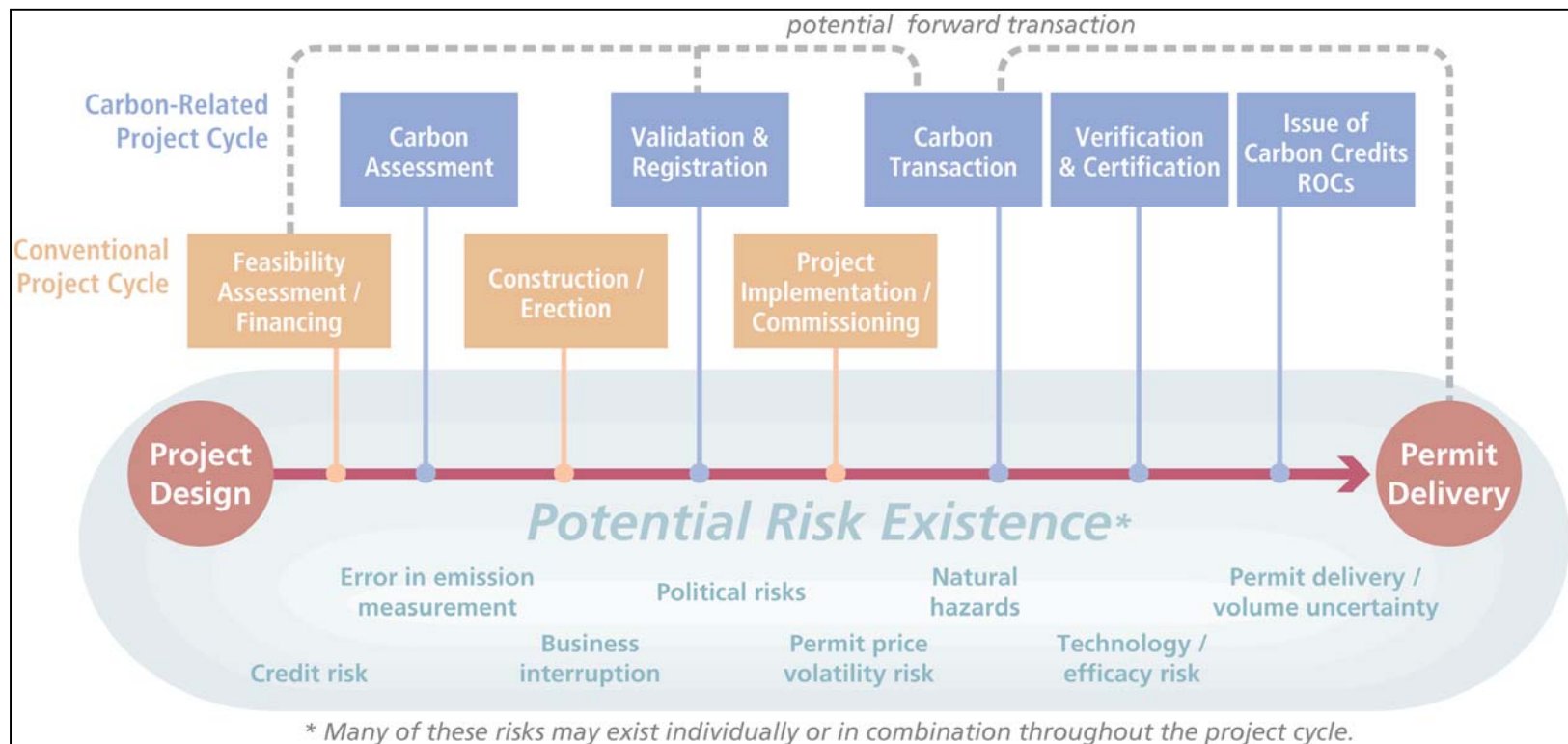
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Source: <http://www.climatehelp.com.au/>

Participating in Carbon Markets

- **AIG, Marsh**, others offering carbon project risk-management consulting services; insurance



Source: Marsh. 2004. "Responding to Climate Change Risks and Opportunities."

Leading by Example

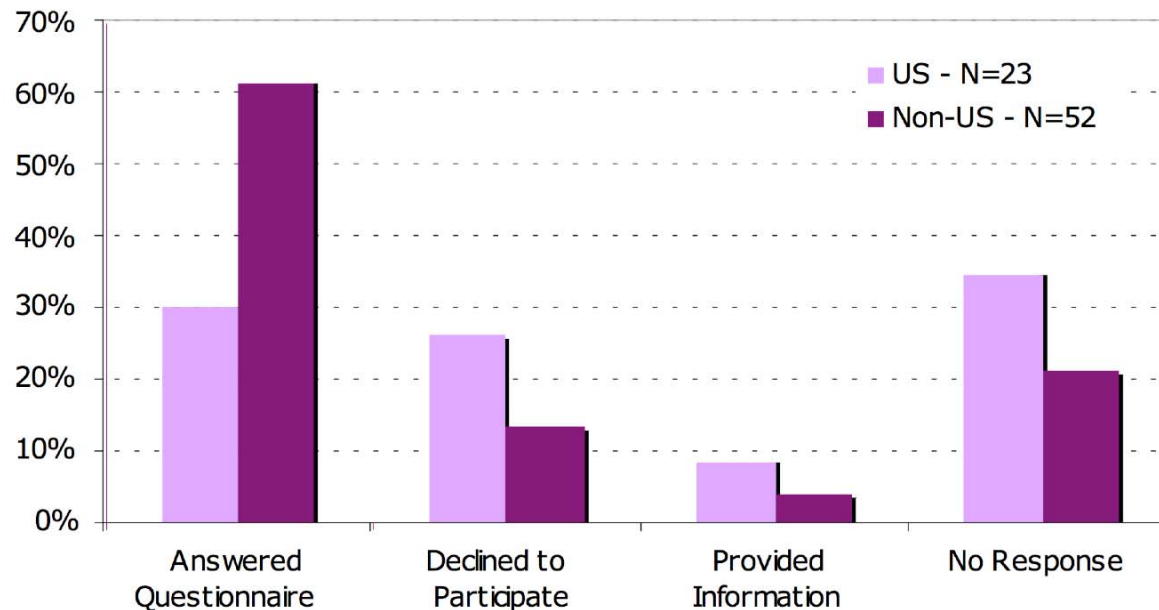
Carbon Disclosure Project

Insurers' responses: *AIG, Aon, Marsh & McLennan, MBIA, Safeco, St. Paul Travelers, Unum Provident*



Swiss Re's
“Gherkin”
building (London)

- Energy efficiency
- Daylighting
- Natural ventilation



Source: <http://www.cdproject.net/>

Sustainable Asset Management

- **Munich Re:** membership in sustainable investment indices; screens its own investments
- **Allianz:** endorsed the Ceres/INCR "Call to Action"
- **Gerling:** Select 21 Fund includes energy and environmental criteria in the selection of securities



Risks Are Also Associated with Responses to Climate Change



- Emissions reductions: supply- and demand-side
 - Green buildings
 - Nuclear power
 - Hydrogen energy
 - Renewable energy
 - Carbon capture & storage
 - Carbon offsets/trading
- Comparative risk assessments needed

Carbon Capture & Storage (CCS)

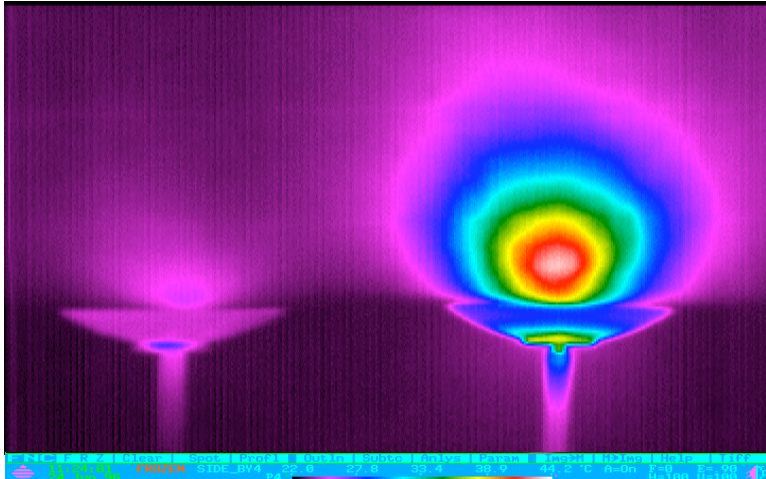
- Lake Nyos - 1986
(Cameroon):
Natural CO₂ leak
killed 1800 people,
3500 farm animals



Win-Win Solutions:

Boston Edison

Fire-causing halogen lamps v CFLs



38W 2D CF Bulb

300 W Halogen Bulb

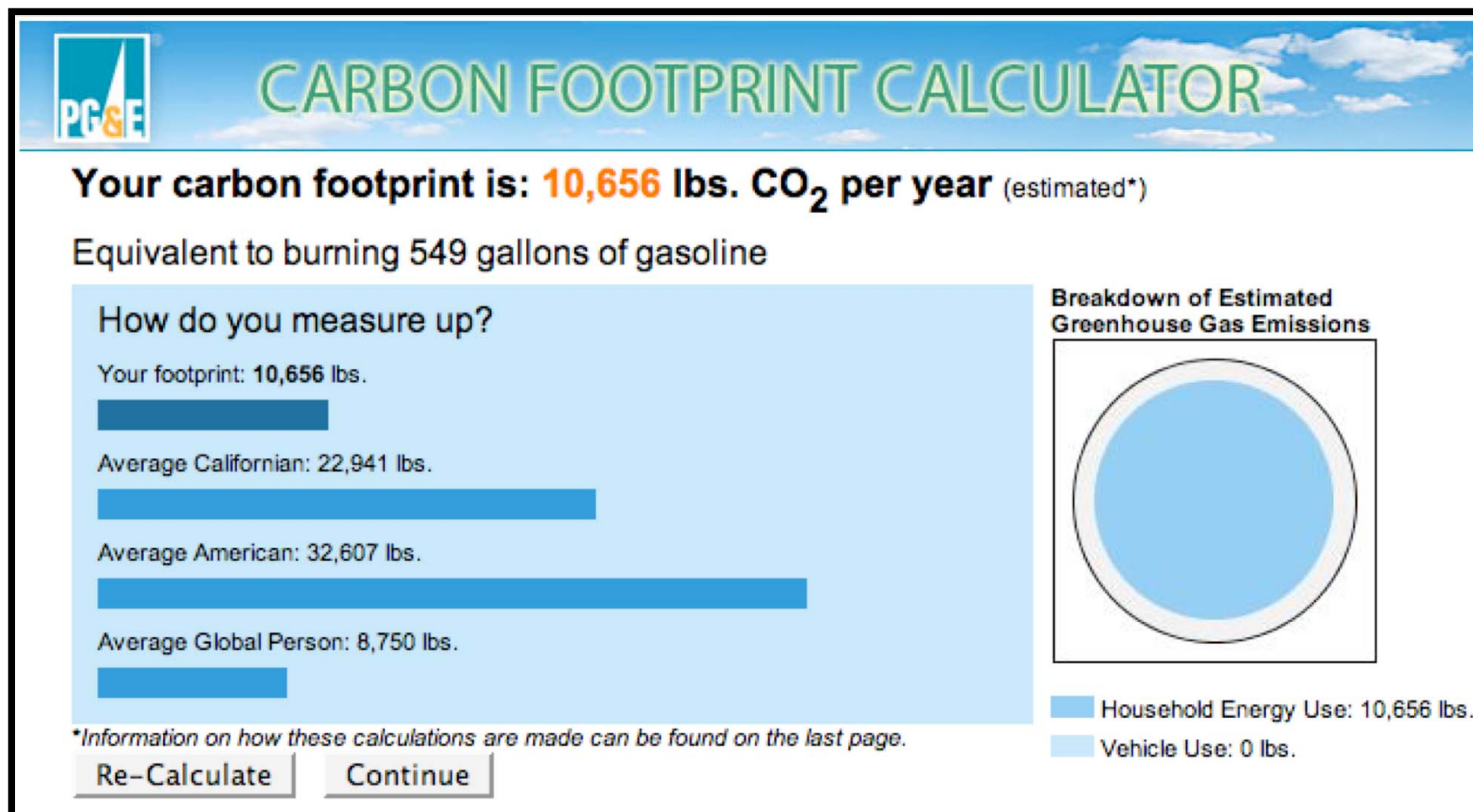


PG&E

Direct-current data centers



Making Lemonade: Energy



Making Lemonade: Water

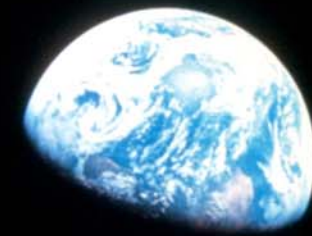


Insurer-Utility Partnerships?

1. Efficiency
2. Risk assessment & management:
customer-facing
analysis, services
3. Energy-carbon
performance
assurance
4. Synergisms between
energy/water
management and risk
management



Thank You



<http://insurance.lbl.gov>

Thank You



<http://insurance.lbl.gov>